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Pelvic MRI in Testosterone-treated Transgender Men: A Case Series and Systematic Review of the Literature

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Abstract

Introduction:

Transmasculine (TM) individuals increasingly use testosterone-based gender-affirming hormone therapy (T-GAHT) while retaining gynaecological pelvic organs, raising questions about long-term pelvic health. Standard assessments like pelvic exams or transvaginal ultrasound can be uncomfortable and may worsen gender dysphoria. Less-invasive imaging techniques like magnetic resonance imaging (MRI) might add to our understanding of pelvic health in T-GAHT.

Methods

We conducted a case series MRI study in 22 gender-affirming pelvic surgery-naive TM individuals using longer-term T-GAHT (mean exposure 70.0 standard deviation [SD] 21.6 months). MRI characterized changes of pelvic organs after longer-term T-GAHT. Additionally, a systematic review was performed of imaging studies evaluating pelvic organs in adults receiving T-GAHT.

Results

Mean endometrial thickness was 3.3 mm (SD 1.2) and total uterine volume was 57.8 mL (SD 41.2). Mean ovarian volume was 5.2 mL (SD 3.6) and follicle count 12.7 follicles (SD 10.2) per ovary. Ovarian parameters were not associated with cumulative testosterone exposure. Polycystic ovary morphology prevalence was 18.2% or 59.1% depending on the definition. No radiological features suggestive of malignancy were identified. The systematic review included eight studies, encompassing data from 700 individuals. Studies were predominantly ultrasound-based and cross-sectional, with only one reporting MRI findings. Endometrial thinning was the most consistent finding across studies.

Conclusions

The study constitutes a first series of pelvic MRI-findings in surgery-naive TM individuals receiving longer-term T-GAHT. Pelvic organ dimensions were largely within expected reference ranges, with a thin endometrium and no structural pathology. The available literature does not support MRI as a routine screening substitute for standard gynaecological surveillance. When imaging is clinically indicated, MRI may serve as an adjunct to ultrasound in selected cases.

1. Background

Following legal changes in Europe, transgender and gender-diverse individuals are no longer required by law to undergo gonadectomy to gain access to care or to change their sex label on official documents. In 2012, Sweden became the first European country to remove the requirement for surgical procedures to obtain legal sex change, followed by 26 other European countries (1). While gender-affirming surgery, including gonadectomy, may be a necessary step for some individuals to feel comfortable in their own bodies, this is not the case for everyone (2). As a result, an increasing number of surgery-naive individuals may pursue long-term, testosterone-based gender-affirming hormone therapy (T-GAHT). This change in treatment patterns raises questions about the overall effect of prolonged hormonal exposure on retained reproductive and pelvic organs.

Current standards of care recommend continued attention to pelvic health, including a scientific focus on pelvic pain complaints and emphasis on the continued need for cervical cancer screening in all individuals with a cervix (3, 4).

Clinical questions nevertheless remain regarding retained pelvic organs, as the long-term effects of T-GAHT are still poorly defined (3–5). This need for a clearer understanding of pelvic health becomes even more pressing in individuals presenting with additional complexities, such as abnormal bleeding or pelvic pain. At the same time, many transmasculine (TM) individuals discontinue routine gynaecological follow-up due to discomfort or dysphoria, limiting access to reliable data on pelvic health (6). This lack of information contributes to uncertainty and an increased perceived need for assessment, which creates a potential role for less invasive assessment techniques.

From a clinical perspective, ultrasound remains the first-line imaging modality for most gynaecological questions. However, transvaginal ultrasound may trigger increased feelings of dysphoria or cause pain due to T-GAHT-related genital atrophy (7, 8). A transabdominal ultrasound negates these aforementioned problems, but may result in suboptimal image quality (9). Pelvic magnetic resonance imaging (MRI) is occasionally used as an adjunct to ultrasound to elucidate indeterminate findings, particularly when prior surgery obscures the anatomy or when more detailed imaging is needed for surgical planning or post-surgical assessment (10, 11). Although MRI is not recommended as a screening tool for gynaecological malignancies in either cisgender or gender-diverse individuals, it may still provide valuable insights into pelvic health patterns in those using hormone therapy.

The aim of the present work was to describe the MRI appearance of retained pelvic organs after longer-term T-GAHT, and to situate these findings within the framework of a systematic review of the broader pelvic imaging literature in TM individuals receiving T-GAHT. In doing so, this work represents the first structured application of MRI for pelvic health assessment in this population.

2. Methodology – Original Research

Our study combines findings from a cross-sectional, MRI-based study within a broader evidence-based framework explored in a systematic review. This methodology section will discuss the original research part.

This study was conducted at the Ghent University Hospital, Ghent, Belgium. Eligible participants were adult TM individuals without prior pelvic gender-affirming surgery who were using longer-term T-GAHT (> 24 months) before the end of data collection on March 16th, 2023. Participants were approached during outpatient follow-up or by telephone. A questionnaire captured T-GAHT regimen details and treatment interruptions.

MRI was used to document longer-term anatomical changes in the retained pelvic organs. Pelvic imaging included T2-weighted and T1-weighted sequences in three orthogonal planes with axial diffusion-weighted imaging centred on the uterus. No intravenous contrast or anti-peristaltic agents were used. All MRIs were reviewed by an experienced radiologist [PDV]. Organ volumes were estimated using the ellipsoid formula (D1×D2×D3×0.523) from three orthogonal diameters (12). Uterine length was measured from the fundus to the isthmus, cervical length from the isthmus to the portio, and endometrial thickness was measured as the double-layer thickness. Ovarian morphology was characterized using ovarian volume and follicle counts. Polycystic ovarian morphology (PCOM) status was reported based on the commonly cited definitions as proposed by the Androgen Excess and Polycystic Ovary Syndrome (PCOS) Society and the Rotterdam PCOS consensus workshop (13, 14). We will refer to the former as the AE-PCOS definition, to the latter as the Rotterdam definition.

Statistical analyses for the cohort were performed in IBM SPSS Statistics, version 28. Associations were explored using Pearson's correlation for continuous variables when appropriate and Spearman's rank correlation for ordinal or non-normally distributed variables. P-values < 0.05 were considered statistically significant. Given the sample size, multivariable regression was not performed. The cohort study was approved by the local ethics committee (EC/2022/0189) and all participants provided written informed consent.

3. Results – Original Research

Twenty-two adult TM individuals were included in the study. Participant characteristics are listed in **Table 1**. Most participants (n=17/22, 77.3%) had used T-GAHT for at least five years. A further three participants (13.6%) had used T-GAHT for 4–5 years. Only two individuals had less than four years of therapy at the time of MRI, with the shortest exposure falling in the 2–3 year range (n=1/22, 4.5%). All but one individual were actively using T-GAHT at the time of the MRI examination. Among those on T-GAHT, testosterone was administered exclusively via intramuscular injection. Concomitant oral progestogen therapy was reported by five participants: in two participants for menstrual suppression, in two others for combined menstrual suppression and contraception, and in one case the indication for use was not reported. A therapy pause was reported in five participants (22.7%) and was usually rather short, with a median of 5.0 months (range: 1.0-17.3). Taking T-GAHT therapy pauses into account, mean absolute total duration of testosterone was 70.0 months (standard deviation, SD: ±21.6) at time of MRI. Reasons for therapy pause were not assessed. None of the participants reported a family history of ovarian or endometrial cancer. None of the participants reported symptoms of pelvic pain.

Table 1. Participant Characteristics

	Transgender men (n=22)
Age at start of T-GAHT (years)	25.0 ±8.8 (range: 15.8-50.6)
Age at time of MRI (years)	31.0 ±9.1 (range: 21.4-57.4)
Time since start T-GAHT (months)	72.1 ±21.5
BMI (kg/m²)	25.4 ±9.4
T-GAHT type • T undecanoate (Nebido®) • T esters (Sustanon®) • No GAHT	 - 12 (54.5%) - 9 (40.9%) - 1 (4.5%)
Progestogen use • None • Lynestrenol (Orgametril®) • MPA (Depo-Provera®)	 - 17 (77.3%) - 4 (18.2%) - 1 (4.5%)
Parity status • Nulliparous • Parous	 - 21 (95.5%) - 1 (4.5%)
Smoking status • Current smoker • Former smoker • Never smoker	 - 4 (18.2%) - 2 (9.1%) - 16 (72.7%)

BMI: body mass index, *MPA*: medroxyprogesterone acetate, *MRI:* magnetic resonance imaging, *T*: testosterone, *T-GAHT*: testosterone-based gender-affirming hormone therapy. Values reported as mean ±standard deviation.

Mean uterine corpus volume was 49.2 mL (SD: ±38.0) and mean cervical volume 8.6 mL (SD: ±3.7), yielding a mean total uterine volume of 57.8 mL (SD: ±41.2). One participant demonstrated a markedly increased uterine volume (207 mL) relative to the other participants, which corresponded with his history of prior parity, as he was the only parous individual in the cohort. After exclusion of the parous participant, mean uterine corpus volume was 42.0 mL (SD: ±17.6) and mean total uterine volume was 50.1 mL (SD: ±19.9). Mean endometrial thickness was 3.3 mm (SD: ±1.2; range 2.0–6.0). Thin endometrium (1–4 mm) was observed in 81.8% (n=18/22), while 18.2% (n=4/22) had an endometrial thickness between 5–7 mm, a thickness similar to that seen in the early proliferative phase of the menstrual cycle (15). No participant had an endometrial thickness ≥8 mm. **Figure 1** illustrates finding of a 'thin' endometrium in one participant. No significant associations were observed between age, progestogen use or duration of testosterone therapy and total uterine volume, or endometrial thickness after exclusion of the parous participant.

On MRI, mean ovarian volume was 5.2 mL (SD: ±3.6) and mean stromal volume 0.5 mL (SD: ±0.4), with a mean follicle count of 12.7 follicles per ovary (SD: ±10.2). PCOM-like morphology was strongly definition-dependent. Based on the ≥12-follicle threshold of the Rotterdam definition, 13 participants (59.1%) met the PCOS-criterion, whereas only four (18.2%) participants met the more stringent ≥25-follicle threshold of the AE-PCOS definition. A total of seven participants (31.8%) had ovarian volume >10 mL in at least one ovary, which is a hallmark of PCOS according to both definitions. **Figure 2** illustrates PCOM in one participant. There was a single participant in whom bilateral ovarian atrophy could be observed; this participant was 57.4 years old at the time of investigation. Age at MRI was inversely associated with follicle count (r=−0.45, p=0.04), whereas cumulative testosterone exposure was not associated with ovarian volume or follicle count. In none of the participants, ovarian endometrioma or features of pelvic endometriosis were observed. No lesions suspicious for ovarian, endometrial or cervical malignancy were detected.

4. Methods – Systematic Review

A systematic review was conducted to identify studies reporting pelvic imaging findings in adult TM individuals receiving T-GAHT. Particular emphasis was placed on identifying cohorts with MRI-based assessments to enable comparison with the present results, and to determine whether any evidence beyond ultrasound-based data was available.

A comprehensive electronic search strategy was constructed using lemmas to capture papers combining the topics of (I.) adult transgender/transmasculine individuals receiving T-GAHT as an intervention (II.) pelvic organs including uterus, cervix, endometrium, ovaries/adnexa), and (III.) medical imaging. The strategy was structured to identify studies examining imaging-based outcomes of pelvic organs in this population, irrespective of the presence of a control group. A search string was constructed for PubMed and subsequently translated for use in different databases namely Embase, Scopus, and Web of Science. The full search strategy can be consulted in the Online Resources (Appendix A). Search results were uploaded to Rayyan, a web-based tool for conducting screening in the context of reviews (16). Duplicates were manually removed by one reviewer [JV]. Subsequently, two reviewers [KB, JV] independently screened titles/abstracts in a blinded fashion within the digital Rayyan environment. Conflicts were resolved by discussion and, when needed, adjudicated by a third reviewer [GT]. Full texts were retrieved for eligible studies. When a full text could not be accessed through institutional resources, corresponding authors were contacted by email. A reminder was sent after two weeks, and records remained excluded if the full text could not be obtained in this manner.

Studies published in English, French, Dutch, or Greek were eligible for inclusion. Non-original data such as reviews or meta-analyses were not eligible for inclusion. Case reports and non–peer-reviewed articles such as conference abstracts were generally ineligible. Case series were included if they were one of the few available studies addressing a specific imaging modality. For included studies, data extraction was performed by two reviewers [KB, JV] using a piloted, standardized form. Extracted variables included: year of publication, study design, sample size, participant

characteristics, T-GAHT specifics such administration route and treatment duration, imaging modality, and imaging outcomes including uterine volume, endometrial thickness, ovarian volume, and ovarian morphology. Units of measurement were converted to present results in a uniform format. Middleton et al. did not report units, so the appropriate units were inferred from context (17).

Risk of bias was assessed by two reviewers [KB, JV] using the ROBINS-E tool (18). Quality assessment was likewise performed by these two reviewers, using the QuADS tool (19). This systematic review was registered in PROSPERO, an international registry for systematic reviews, under the identifier: CRD420261293210. This manuscript was drafted according to the PRISMA 2020 guidelines for systematic reviews (20).

5. Results – Systematic Review

5.1. General findings

A total of 674 unique articles were screened on title and abstract. Following full text screening, eight studies were withheld for data extraction (17, 21–27). The full selection process can be consulted in a flowchart, shown in Fig. 3. Across these eight studies, imaging data from a total of 700 participants were reported, with sample sizes ranging from 43 to 325 individuals. Most studies assessed pelvic organs using ultrasound, with techniques varying across cohorts. Two studies reported on the same cohort in which transvaginal ultrasound was used exclusively (21, 24), three used both transabdominal and transvaginal approaches (22, 23, 26), one relied solely on transabdominal imaging (25), and one did not specify the ultrasound technique used (17). Only one study incorporated MRI, and this was limited to a small subset of nine participants without detailed organ measurements. No CT studies met the eligibility criteria, and therefore none were included. A single study incorporated both ultrasound modalities along with a limited subset of MRI data, though only endometriosis presence was reported, omitting data on pelvic organ dimensions (24, 27). Two studies included longitudinal imaging to monitor pelvic changes following initiation of testosterone therapy (23, 25). Two overlapping research papers used a historic cohort of cisgender women as a control group (21, 24). A ninth study prospectively monitored body composition parameters over the first two years of T-GAHT (28). Presence of endometriomas was documented in two cases (n = 2/45, 4.4%) at baseline. Since no specific pelvic organ dimensions were documented, this paper was not included in the review.

Across studies, the approximate pooled age was 24.8 years, calculated from reported central tendency measures weighted by sample size. The approximate pooled duration of T-GAHT, excluding Giacomozzi et al., was 32.4 months (17, 21–26). Across studies with available medication data, approximately 78.2% of participants received testosterone via intramuscular or subcutaneous injections (17, 21, 22, 24, 25, 27).

5.2. Uterus and Endometrium

A total of six studies reported on endometrial thickness, with all studies using ultrasound (17, 22–26). Across these studies, endometrial thinning under T-GAHT was the most common finding. An average endometrial thickness of less than 4mm was observed across four studies (17, 22, 24, 25). In Middleton et al., no significant differences in endometrial stripe measurements were observed between individuals with and without uterine bleeding, calling into question the diagnostic utility of routine ultrasound assessment of endometrial thickness in this context (17).

Prospective data demonstrated marked endometrial thinning during the first year of therapy. Pallotti et al. observed a significant reduction of the endometrial thickness by 6 months that persisted at 12 months (-62.7%, p = 0.001) (25). A second prospective study also noted a significant reduction in endometrial thickness over the first year of T-GAHT (23). Whilst endometrial thickness decreased by approximately one-fifth (-20.3%, p = 0.05), mean endometrial thickness at

the end of follow-up was still reported to be 5.4mm ± 2.9 (23). In this same paper, researchers also assessed a cross-sectional cohort, documenting a mean endometrial thickness of 4.6mm ± 2.3 (23). One paper in 46 participants documented hyperplasia of the endometrium, prompting an endometrial biopsy, which was reassuring (24).

Uterine dimensions were documented less systematically. Uterine volume decreased by approximately one quarter (-23.8%, p = 0.001) over the course of one year of T-GAHT, reaching a mean value of 38.8mL ± 11.7 (25). Middleton et al. similarly reported uterine dimensions. However, because only length and transverse diameter were available, estimation of uterine volume was not feasible (17). Presence of uterine fibroids was reported to be less than 10% in the TM cohort (n = 5/51) of Asseler et al. (24). This was not significantly different to the rate reported in the cisgender control cohort (n = 7/77, 9.1%) (24). The Giacomozzi et al. paper was the only instance of MRI use in a cohort of TM individuals. Only nine participants underwent MRI imaging, with one participant thought to have endometriosis based on the exam findings. No specific pelvic organ dimensions were reported (27).

5.3. Ovaries

A total of five studies reported on ovarian parameters (17, 21–23, 25). Compared to a cisgender control group, TM participants on longer-term T-GAHT did not have significantly different antral follicle counts (AFC) (21). A prospective paper documented stable AFC during the first year of T-GAHT in those participants without PCOS (23). In individuals with a pre-existing PCOS diagnosis, AFC did decrease significantly by nearly one third (-29.4%, p = 0.05) (23). A final study reported apparent absence of ovarian activity, as evidenced by lack of follicles on ultrasound examination (25). The exclusive use of transabdominal ultrasound, which has lower sensitivity for follicular detection than transvaginal imaging, may have reduced diagnostic accuracy and could explain the reported findings (25). Three studies reported on ovarian volume, with the Caanen et al. group documenting an ovarian volume in the T-GAHT treated group which was one fifth smaller (-21.7%, p = 0.05) than in cisgender female controls, reaching a median value of 5.4mL (21). This ovarian volume was quite similar to the one observed by Middleton et al., who also assessed a cohort of TM with average T-GAHT use exceeding 24 months (17). However, this similarity was observed only for the left ovaries. In contrast, the right ovaries were notably smaller, with mean volumes ranging between 2.6 and 2.9 mL (17). These values closely approximate those reported by Pallotti et al. at the end of the first year of T-GAHT, where ovarian volume was approximately 2.6 mL, representing an estimated 60% reduction relative to the hormone-naive baseline (25).

A notable feature of two cohorts is the high prevalence of PCOS at baseline (21, 23). Yaish et al. reported that nearly half (n = 27/56, 48%) had a PCOS-diagnosis (23). PCOM was also prevalent in a Dutch cohort, with 32.1% of TM participants displaying ultrasonographic hallmarks (21). Although it should be noted that the prevalence of PCOM in the cisgender controls also reached 30.7%, meaning there was no significant difference between groups, even after adjusting for age and gonadotropin-releasing hormone agonist (GnRHa) use (21). Results from the latter study prompted the authors to conclude that there was no reason to suspect T-GAHT exposure would induce PCOM (21). Contrastingly, Borrás et al. only documented only one case (n = 1/55, 1.8%) of PCOM during the ultrasonographic examination part of their study (22). Borrás et al. also integrated a histological examination in their study design. During anatomopathological assessment of extirpated ovaries, mild thickening of the tunica albuginea and luteinisation of the stomal cells was noted, indicative of PCOM. However, other distinct features of complete PCOM such as stromal hyperplasia were absent (22).

5.4. Quality and Bias

The average evidence quality as indicated by the QuADS-score was moderate at 25.8/39 (66.0%), with scores ranging from 18/39 (46.2%) to 30/39 (76.9%). The majority of studies (n = 5/8, 62.5%) were judged to be at high risk of bias, while the remaining studies (n = 3/8, 37.5%) were considered to have a moderate risk of bias. The QuADS-quality assessment and risk of bias evaluation can be consulted in the Online Resources (Appendix B & C).

Table 2. Central overview table of studies included in the review

Author (YoP)	Technique	Cohort	Controls	GAHT duration	Results	Conclusion
Caanen (2017)	Single TV-US (n = 53)	Adult TM treated with longer-term T-GAHT, and scheduled for hysterectomy (n = 56, 53 with US). Median age (IQR): 22.8y (19.6–26.3).	Adult CW from the DCOG-LATER-VEVO study (n = 80). Median age (IQR): 34.0y (31.0-35.9).	Median: 29.5m	*Values as median (IQR)* - AFC: 6.8 follicles (4.4–15.8), NS different - OV: 5.4mL (3.9-8.0), -21.7%↓ vs. controls* - PCOM: 32.1%, NS different	T-GAHT does not induce in PCOM
Asseler (2022)	Single TV-US (n = 51)	TM on T-GAHT ≥ 1 year, eligible for gender-affirming surgery (n = 51). Median age (IQR): 22.6y (19.3–26.3) Unpublished data from Caanen et al. (2017)	CW from Dutch LATER-VEVO study (n = 77). Median age (IQR): 34.0 (30.9–36.0)	30.2m ± 8.8	- ET: 3.9mm, -20.4%↓ vs. controls*** - Uterine fibroids in 9.8%, NS different vs. controls	ET significantly lower in T-GAHT users vs. CW
Borrás (2019)	Single TV-US (n = 32) or TAb-US (n = 23)	Adult TM treated with > 2y of T-GAHT, and scheduled for hysterectomy (n = 70, 55 with US). Age: 27.7y ± 5.1.	None	28.3m ± 3.4	- Ovaries not visualised in 8 cases - Antral follicles in 43/47 US (91.5%) in absence of dominant follicle or corpus luteum. - ET on TV-US between 1-3mm (thin) in all available cases. - One case of PCOM (1.8%), normal US in 4 cases of previous PCOS diagnosis	No PCOM induction by T-GAHT based on imaging alone. Some T-GAHT hallmarks during histological examination

Table 2. Central overview table of studies included in the review

Yaish (2021)	Repeated TV-US (n = 30) or TAb-US (n = 26) at T0 and T12	Nulliparous, hormone-naive, gGAS-naive TM aged 16y or over (n = 56). Median age (IQR): 22.5 (19.0-27.8)	Self-controlled	FU over 12m	- ET: 5.4mm ± 2.9, -20.3%↓ vs. baseline* - in PCOS cases, AFC: 12 follicles, -29.4%↓ vs. baseline* - in non-PCOS cases, AFC: 13.4 follicles, + 14.5%↑ vs. baseline, NS - PCOS phenotype in 27 cases at baseline	No significant effect of T-GAHT on ovarian indices.
	Single TV-US (n = 20) or TAb-US (n = 9)	gGAS-naive TM on T-GAHT aged 16y or over (n = 47, 29 with US). Median age (IQR): 24.0 (20.0–31.0)	None	48.2m ± 48.5, range: 7-219m	- AFC: 9.6 follicles ± 6.8 - ET: 4.6mm ± 2.3 - No correlation between AFC and GAHT duration.	
Pallotti (2023)	Repeated TAb-US at T0, T6 and T12 (n = 52)	Adult hormone-naive TM (n = 52). Age: 24.8y ± 8.6	Self-Controlled	FU over 12m	*Values at T12*: - UV: 38.8mL ± 11.7, -23.8%↓ vs. baseline*** - ET: 1.9mm ± 1.4, -62.7%↓ vs. baseline*** - OVright: 2.7mL ± 1.7, -58.5%↓ vs. baseline*** - OVleft: 2.6mL ± 1.7, -62.3%↓ vs. baseline***	Significant decrease of pelvic organ dimensions during first year of T-GAHT.
Rahman (2024)	Single TV-US (n = 18), TAb-US (n = 27) or US (n = 1) - retrospective	Adult TM scheduled for gGAS (n = 57, 46 with US in 5y before surgery). Age: 27.2y ± 6.7	None	53.2m ± 38.3 No active T-GAHT use in 4 cases.	- UV: 87.2mL ± 41.8 - Increased ET in one case - Presence of leiomyoma in five cases (10.9%)	Pre-surgery US did not affect decision making.

Table 2. Central overview table of studies included in the review

Middleton (2025)	Single US (n = 144) - retrospective	TM adolescents and adults on T-GAHT, without bleeding symptoms (n = 81). Median age (IQR): 20.0 (18.0–22.0)	Comparison between bleeding symptom groups	40.8m ± 20.4	- Ulength: 71mm ± 14 - Uwidth: 31mm ± 9 - OVright: 2.57mL - OVleft: 5.18mL - ET: 2.48mm ± 0.78	No differences between US measurements in people on T-GAHT with or without bleeding symptoms.
		TM adolescents and adults on T-GAHT, with bleeding symptoms (n = 63). Median age (IQR): 18.0 (16.0–22.0)		34.8m ± 24	- Ulength: 70mm ± 17 - Uwidth: 33mm ± 11 - OVright: 2.87mL - OVleft: 5.79mL - ET: 2.50mm ± 0.85 *No units of measurement reported in original paper.*	
Giacomozzi (2026)	Single TV-US (n = 43), TAb-US (n = 213), MRI (n = 9)	Adult TM scheduled for gGAS (n = 325, 265 with imaging). Age approximation: 27.5y ± 9.1	None	N = 310 with T-GAHT use, n = 299 with documented duration: 38.5%: ≥5y, 37.8%: 3-4y, 18.4%: 1-2y, 5.4%: ≤1y	TV-US group: no endometriosis detected TAb-US group: 3/213 with endometriosis MRI group: 1/9 with endometriosis with subsequent histological confirmation	Low endometriosis rate, potentially linked to longer T-GAHT duration. Imaging accuracy and appropriateness could not be assessed.

↓: lower/decreased, ↑: higher/increased, *AFC*: antral follicle count, *CW*: cisgender women, *DCOG-LATER-VEVO*: Dutch Childhood Oncology Group–Long-Term Effects After Childhood Cancer, *ET*: endometrial thickness, *GAHT*: gender-affirming hormone therapy, *gGAS*: genital gender-affirming surgery, *IQR*: interquartile range *m*: months, *MRI*: magnetic resonance imaging, *OV*: ovarian volume, *PCOM*: polycystic ovary morphology, *PCOS*: polycystic ovary syndrome, *T0*: baseline, *T6*: 6 months after start of hormone therapy, *T12*: 12 months after start of hormone therapy, *T-GAHT*: testosterone-based gender-affirming hormone therapy, *TM*: transmasculine individuals, *TV-US*: transvaginal ultrasound, *US*: ultrasound (type not specified), *UV*: uterine volume, *vs.*: versus, *y*: years, * p = 0.05, **p = 0.01, ***p = 0.001, ****p < 0.0001, NS: not significant(ly)

6. Discussion

This paper presents findings from a cohort of surgery-naive TM individuals undergoing long-term T-GAHT. It should be noted that this was undertaken to expand the available data on pelvic health, rather than to position MRI as a replacement for first-line ultrasound, cervical cytology, or endometrial sampling. The main contribution of this paper is that it expands upon the ultrasound-based literature by providing the first MRI-based evaluation of retained pelvic organs in TM individuals using longer-term T-GAHT. It is positioned within a systematic review of the available imaging evidence. The review component of this paper synthesizes results from studies focusing on imaging techniques used to assess pelvic organs in TM individuals receiving T-GAHT. Despite reports of pelvic pain or breakthrough bleeding during T-GAHT use, imaging studies remain rare and methodologically heterogeneous (4, 5).

Although MRI is frequently used in the context of genital gender-affirming surgery, particularly in transfeminine individuals (11, 29), its application in pelvic health assessment among TM individuals has previously been described only once (27). That study included a very small MRI cohort of nine participants and did not report pelvic organ dimensions. The imaging was performed as part of an endometriosis diagnostic work-up. The authors concluded that neither transvaginal ultrasound nor MRI reliably detected surgically confirmed endometriosis (27).

One uterine parameter that was regularly reported was endometrial thickness, with the most common observation being endometrial thinning (< 4 mm). Findings from the MRI-cohort thus fit neatly within the observations from the reviewed papers, with its mean thickness of 3.3 mm. Histology-based studies have reported both proliferative and inactive endometrium under T-GAHT, and there is no good explanation for the duality in endometrial observations (30). Theoretically, the presence of estrogen-producing ovaria and aromatization of exogenous testosterone into estrogen may be possible mechanisms that could contribute towards proliferative changes (31, 32). Conversely, an atrophic endometrium might be the consequence of the direct androgenic effect of T-GAHT on the androgen receptors expressed in the endometrium (31). Histopathological studies in TM individuals undergoing gender-affirming hysterectomy demonstrate a spectrum of endometrial appearances, ranging from atrophic to proliferative, even in those without bleeding or spotting (33). This underscores that amenorrhea does not necessarily indicate endometrial quiescence (34). Consistent with these findings, breakthrough bleeding is reported in approximately one third of individuals during the first years of T-GAHT (5). This supports our MRI cohort finding of a thin endometrium with variable activity in long-term T-GAHT users.

In the MRI-based portion of the study, no participants showed imaging evidence of endometriosis. However, previous studies have reported prevalence rates ranging from 3.1% to 26.9% among individuals undergoing T-GAHT, and endometriosis has been identified as a potential contributor to pelvic discomfort in this population (27, 35). It is possible that very subtle superficial lesions were not detected on MRI (36). Nevertheless, MRI can complement ultrasound in the evaluation of deep infiltrating endometriosis and in pre-surgical planning. Thus, MRI may be a useful adjunct in assessing pelvic pathology in TM individuals when clinically indicated (36).

With regard to ovarian parameters, findings from the reviewed studies were consistent with those observed in the MRI cohort. The mean follicle count in both the MRI cohort and the study by Yaish et al. was approximately 12 follicles (23). In contrast, MRI-based studies of cisgender women with PCOS have reported substantially higher mean follicle counts, typically ranging from the high teens to the low twenties (37, 38). The mean ovarian volume in our cohort was 5.2mL, which was largely in line with the values reported in the literature, including the Caanen et al. cohort and selected subsets from the Middleton et al. paper (17, 21).

The overall body of evidence did not support the hypothesis that T-GAHT induces PCOM (39, 40). This is consistent with the findings from the MRI-cohort, which also failed to demonstrate a clear association between T-GAHT exposure and follicle count. Nevertheless, PCOM was observed in more than half (59.1%) of participants in the MRI-cohort when

applying the Rotterdam criteria. In the absence of baseline data, it remains unclear whether these findings were already present prior to the initiation of T-GAHT. It is possible that baseline prevalence rates are inherently high, as reported in the Asseler et al. cohort (24). When the more stringent AE-PCOS criteria were applied to the MRI-cohort, the prevalence of PCOM was considerably closer to rates reported for the general population at 18.2% of participants (41). The PCOS diagnostic criteria were originally developed for ultrasound imaging. Ultrasound has lower spatial resolution than MRI and is more dependent on operator technique. This difference in imaging performance may contribute to overdiagnosis of PCOM when MRI is used (38). Still, one should be prudent not to completely dismiss the potential influence of T-GAHT on the occurrence of PCOM in the presence of such high rates. The pathophysiology of PCOS is complex and involves a self-perpetuating interaction between excess luteinizing hormone (LH) secretion and hyperandrogenism. This hormonal imbalance disrupts normal follicular maturation, resulting in multiple small follicles that are arrested in the pre-antral stage (42–44). Given this mechanism, it is biologically plausible that exogenous testosterone administered as part of T-GAHT could induce ovarian alterations resembling those observed in PCOS. Alternatively, there may be a testosterone-specific, GAHT-related ovarian morphology that is distinct from PCOS. Borrás et al. demonstrated that some, but not all, hallmarks of PCOS are present in the TM population, suggesting that this pattern could represent an independent clinical entity rather than a variation of PCOS (22).

The limited longitudinal data available suggests that pelvic organ dimensions tend to decrease following exposure to T-GAHT. Besides one case of ovarian atrophy that was considered age-congruent, the MRI-cohort could not clearly corroborate these findings of volume reduction. Based on combined ultrasound, MRI and histological data from cisgender individuals, the expected age-appropriate ovarian volume within the MRI cohort would be approximately 6.0 mL (45). The observed values were only slightly smaller than anticipated, at 5.2mL. In the MRI cohort, the mean uterine volume was 57.8 mL. This value lies between the volumes reported by Pallotti et al., who found a mean of 38.8 mL, and Rahman et al., who reported a mean of 87.2 mL. This value is likewise very close to the mean uterine volume reported for 100 healthy cisgender women who had undergone pelvic MRI, namely 49.8mL (46).

Pelvic MRI is not recommended as a routine screening method for gynaecological malignancies in either cisgender or gender-diverse individuals. It cannot replace cervical cytology, nor can it distinguish endometrial hyperplasia from endometrial cancer with the level of certainty provided by endometrial sampling. The lack of suspicious MRI findings in the present cohort should therefore be interpreted cautiously and should not be taken as evidence that malignancy was excluded. More broadly, T-GAHT itself does not appear to necessitate additional follow-up or confer an increased risk of pelvic organ cancers (3, 47). However, the current evidence is mainly based on people using less than five years of T-GAHT, and it remains uncertain whether use extending over several decades may alter this risk profile. Imaging should therefore remain guided by symptoms or specific clinical questions, such as bleeding, pelvic pain, or suspicion of structural pathology, with MRI serving only as a complementary modality in selected cases. Individuals should continue to have access to established expertise, including ultrasound whenever relevant.

The average T-GAHT duration in the MRI-cohort exceeded five years, which was a notable strength of this study. The most important limitation of the original research part of this paper is the small sample size, which made more advanced statistical analyses challenging. Since all study participants identified as transgender men, we could not include a gender nonbinary perspective. Absence of clear baseline PCOS status was also an important barrier. The small sample size precluded meaningful subgroup analyses, including according to concomitant progestogen use. A further major limitation is the absence of histopathology or other clinical reference standards. Participants did not undergo a Papanicolaou smear or endometrial sampling alongside MRI, meaning that the correctness of the imaging findings for endometrial or cervical pathology could not be assessed. Finally, this study focused primarily on pelvic organs and did not examine pelvic muscle size. Future research could explore this in more depth, including efforts to quantify pelvic muscle tone, since the anabolic effects of T-GAHT may influence pelvic musculature as well.

7. Conclusions

This study presents MRI-based pelvic findings in surgery-naive transmasculine individuals receiving long-term T-GAHT, and a systematic review of the literature. We found that pelvic organ dimensions were generally reduced or within expected reference ranges, endometrial thickness was predominantly thin, and no radiological features suggestive of malignancy were identified. Overall, current evidence does not support routine additional pelvic imaging in asymptomatic individuals beyond established screening recommendations. Effect of T-GAHT in a very long-term setting warrants additional investigation.

Abbreviations

AFC
antral follicle count
BMI
body mass index
CT
computed tomography
ET
endometrial thickness
FU
follow-up
GAHT
gender-affirming hormone therapy
gGAS
genital gender-affirming surgery
IQR
interquartile range
MPA
medroxyprogesterone acetate
MRI
magnetic resonance imaging
OV
ovarian volume
PCOM
polycystic ovarian morphology
PCOS
polycystic ovarian syndrome
SD
standard deviation
T
testosterone
Tab
transabdominal
T-GAHT
testosterone-based gender-affirming hormone therapy
TM

transmasculine
TV
transvaginal
US
ultrasound
UV
uterine volume
YoP
year of publication

Declarations

Ethical Committee and Consent:

The study was conducted in accordance with the Declaration of Helsinki, and the protocol of the ELANTES study has been approved by the ethical committee of the Ghent University Hospital (EC/2022/0189). Written informed consent given by enrolled participants. No minors were included in this research.

Consent for publication:

Not applicable

Data Sharing Agreement:

Upon reasonable request

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Conflict of Interest:

None to declare

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Figures

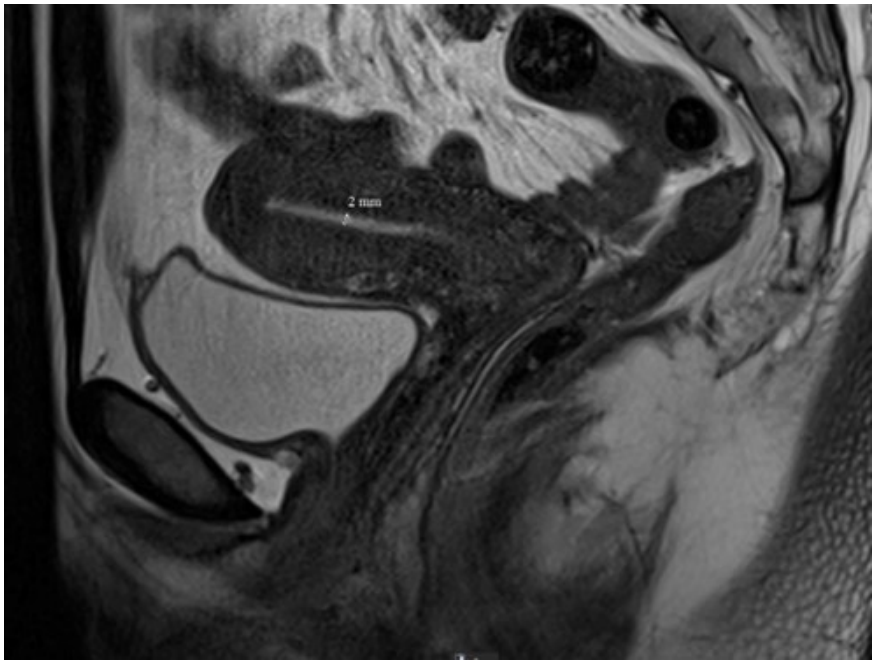


Figure 1

Example of a thin endometrium on MRI. Double-headed arrow showing endometrial thickness.



Figure 2

Example of polycystic ovaries on MRI. White circles drawn around the ovaries.

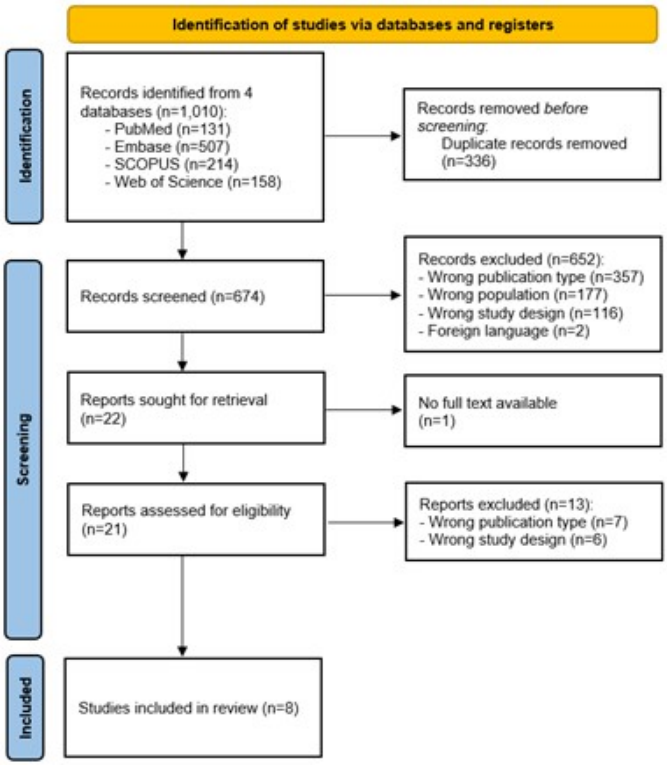


Figure 3

Flowchart of the paper selection process.

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