Analisis Komparatif Luaran Kehamilan dan Efektivitas Klinis Pasca-High Intensity Focused Ultrasound (HIFU) vs Laparoscopic Myomectomy pada Pasien Mioma Uteri: Sebuah Tinjauan Literatur Sistematis

Florencia Desiree
Faculty of Medicine Universitas 17 Agustus 1945 Surabaya
E-mail: florenciadesiree88@untag-sby.ac.id

ABSTRACT

Background: Comparing HIFU and LM for pregnancy outcomes in uterine fibroids. **Methods:** Systematic review of 15 studies (2020–2025). **Results:** Both show similar pregnancy rates (70–82%). HIFU significantly shortens time to conception (10–12 vs 13–18 months) and increases vaginal delivery rates due to its non-invasive nature. **Conclusion:** HIFU is a faster, safe alternative for fertility preservation.
Keywords: *Uterine fibroids, HIFU, Myomectomy, Pregnancy Outcome*

ABSTRAK

Latar Belakang: Membandingkan luaran kehamilan antara HIFU dan LM pada mioma uteri. **Metode:** Tinjauan sistematis 15 studi (2020–2025). **Hasil:** Angka kehamilan kedua metode setara (70–82%). HIFU secara signifikan mempercepat waktu tunggu hamil (10–12 vs 13–18 bulan) dan meningkatkan peluang persalinan normal. **Kesimpulan:** HIFU adalah alternatif non-invasif yang lebih cepat dan aman untuk menjaga kesuburan.
Kata Kunci: *Mioma uteri, HIFU, Miomektomi, Luaran Kehamilan*

Introduction

Uterine fibroids, or leiomyomas, are benign neoplasms originating from the smooth muscle cells of the myometrium. They are the most prevalent gynecological tumors, affecting 70–80% of women of reproductive age.[1] Clinically, fibroids frequently manifest as abnormal uterine bleeding, chronic pelvic pain, and reproductive system dysfunction.[2,8] For women planning a pregnancy, the choice of therapy must balance the effectiveness of tumor removal with the preservation of uterine structure and vascularization.[12,15] For several decades, Laparoscopic Myomectomy (LM) has been widely accepted as the gold standard; however, it involves myometrial incisions that leave surgical scarring on the uterine wall.[5,10] As an alternative, High-Intensity Focused Ultrasound (HIFU) has emerged as a non-invasive technology that delivers thermal energy to induce coagulative necrosis without the need for incisions.[3,9,15]

Methodology

This study is a systematic literature review of clinical studies published between 2020 and 2025.[1,3,5] Searches were conducted via PubMed, ScienceDirect, and Google Scholar using keywords related to HIFU, LM, and pregnancy outcomes.[2,5] Data were synthesized narratively to compare parameters such as pregnancy rates, time interval to conception, and delivery safety.

Clinical Effectiveness and Volume Reduction Analysis

The clinical effectiveness of both procedures was assessed based on their ability to eradicate the tumor mass. In LM, mass removal occurs instantaneously through surgical excision, whereas HIFU induces progressive volume shrinkage of 40–60% within 6–12 months.[11,15] HIFU demonstrates superiority in tissue selectivity without disrupting healthy myometrial vascularization, unlike LM, which potentially damages ovarian reserve due to the use of electrocautery.[6,7] In terms of patient comfort, HIFU significantly lowers pain scores and accelerates the recovery time for normal activities.[12,15]

Comparison of Pregnancy Outcomes

There are no statistically significant differences between HIFU and LM regarding natural pregnancy rates (70%–82%).[5,13] However, HIFU patients have a significantly shorter median time to conception (10–12 months) compared to the LM group (13–18 months).[1,9,14] Furthermore, the intact uterine wall integrity post-HIFU is associated with a lower risk of uterine rupture, leading to a higher probability of vaginal delivery (~45%) compared to the LM group (~30%).[4,10,11] The comparison of characteristics between the two modalities is summarized in Table 1.

Tabel 1. Perbandingan Karakteristik Klinis dan Luaran Reproduksi: HIFU berbanding LM

Comparison Parameter	High-Intensity Focused Ultrasound (HIFU)	Laparoscopic Myomectomy (LM)
Method of Action	Non-invasive (Thermal Energy)	Minimally Invasive (Surgical Excision)
Volume Reduction	Gradual (40-60% in 6-12 months)	Instant (Mass removed immediately)
Recovery Time	2-4 Days	14-21 Days
Pregnancy Rate	70% – 82%	70% – 80%
Time to Conception	10 – 12 M**oths**	13 – 18 M**oths**
Uterine Integrity	Maintained	Scar on Myometrium
Mode of Delivery	Vaginal Delivery	Caesarean Section
Uterine Rupture Risk	Minimal	Higher rist at the scar site

Advantages, Limitations, and Technical Considerations

The primary advantage of HIFU lies in the minimal risk of pelvic adhesions and the preservation of uterine vasculature for embryo implantation.[7,8,12] However, its effectiveness depends on technical aspects such as bowel positioning and abdominal fat thickness.[2] On the other hand, LM remains crucial for cases involving large numbers of multiple fibroids and allows for histopathological confirmation.[10,15]

Conclusion and Recommendations

HIFU is a safe and effective alternative for women planning a pregnancy.[5] Its superiority in shortening the interval to conception makes it an attractive choice compared to LM.[1,9] Further research is required to monitor the long-term health of infants born post-HIFU.[6,14]

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