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Frequency of Coexisting Adenomyosis in Women with Uterine Leiomyomas: MRI Findings and Detection by Transabdominal Ultrasound

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ABSTRACT

Background: Adenomyosis often coexists with uterine leiomyomas and affects uterus-sparing treatment, but it is difficult to see on transabdominal ultrasound (US). We assessed how often MRI showed adenomyosis in women with a leiomyoma as the main lesion, and whether the preceding US reported it.

Methods: We reviewed the reports of 91 consecutive women who underwent transabdominal US followed by 1.5-T pelvic MRI for a gynaecological indication in Jazan, Saudi Arabia (May 2023–July 2025). Women whose main MRI lesion was a leiomyoma formed the study group. We assessed agreement between US and MRI using Cohen's kappa, PABAK, and the exact McNemar test, and compared groups using Fisher's exact and Mann–Whitney U tests.

Results: Fifty-one women (mean age 44.1 ± 9.5 years) had a leiomyoma as the main lesion, and 13 of them (25.5%; 95% CI 14.3–39.6) also had adenomyosis on MRI. Age was similar (43.2 vs 44.4 years; $p = 0.72$), but women with coexisting adenomyosis were more often referred for menstrual symptoms (38.5% vs 10.5%; $p = 0.036$). In these 13 women, transabdominal US reported a leiomyoma in 11 and an ovarian or adnexal cyst in 2, and it reported adenomyosis in none (0/13; 95% CI 0–24.7; $\kappa = 0.00$; PABAK = 0.49; McNemar $p < 0.001$).

Conclusion: About one in four women with a leiomyoma on MRI also had adenomyosis, which the preceding transabdominal US did not report. MRI should be considered before uterus-sparing treatment of presumed leiomyomas, particularly in women with heavy bleeding or dysmenorrhoea.

KEYWORDS: Adenomyosis, Leiomyoma, Magnetic resonance imaging, Ultrasound, Uterus.

1. INTRODUCTION

Uterine leiomyomas are the most common pelvic tumours in women, with a cumulative incidence exceeding 70% by age 50 years [1]. Adenomyosis, the presence of endometrial glands and stroma within the myometrium, is frequently found in the same uterus: it is reported in 15–57% of uteri removed for leiomyomas, and in up to half of women with adenomyosis also have leiomyomas [2]. Both conditions cause heavy menstrual bleeding, dysmenorrhoea and an enlarged uterus, so the clinical picture alone rarely distinguishes them.

The distinction matters for treatment. Myomectomy removes discrete leiomyomas but not diffuse adenomyosis, and responses to uterine artery embolization, high-intensity focused ultrasound, and hormonal treatment differ between the two conditions. Unrecognized adenomyosis can therefore explain persistent symptoms after uterus-sparing treatment for presumed leiomyomas. European guidelines support MRI for planning uterus-sparing treatment and recommend that coexisting adenomyosis be reported [3].

MRI shows the junctional zone and identifies adenomyosis more reliably than ultrasound (US) [4–6]. Transvaginal US can be as accurate as MRI [7], particularly with standardised MUSA criteria in expert hands [8], but in many settings, including among women who have not been sexually active, transabdominal US is the only US available. Its resolution of the myometrium is

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limited, and a large leiomyoma can obscure the rest of the uterus. In a histopathological comparison, transabdominal US sensitivity for adenomyosis was only 32.5% [4].

In Saudi Arabia, an MRI study from the Qassim region described the frequency of leiomyoma and adenomyosis but did not examine their coexistence [9]. A histopathological series from the Eastern Province found adenomyosis together with leiomyoma in about one in four hysterectomy specimens with leiomyoma [10], and studies from Riyadh have shown the limitations of US in characterising uterine lesions [11,12]. No Saudi study has assessed how often coexisting adenomyosis is detected on US compared with MRI. This study aimed to determine the frequency of coexisting adenomyosis on MRI in women whose main lesion was a leiomyoma, to compare women with and without coexisting adenomyosis, and to assess agreement between transabdominal US and MRI for its detection.

2. MATERIALS AND METHODS

Study design and setting: This retrospective observational study was performed in the Jazan Region, Kingdom of Saudi Arabia. We reviewed pelvic MRI examinations performed between May 2023 and July 2025 and collected data from the picture archiving and communication system and electronic medical records between October 2024 and October 2025. The study follows the STROBE guidelines.

Study population: A total of 120 consecutive women underwent pelvic MRI for a gynaecological indication and had a complete MRI report. Of these, 91 also had a complete transabdominal US report from the month before the MRI. Women whose main MRI lesion was a leiomyoma (n = 51) formed the study group (Figure 1). Women whose main MRI lesion was another condition were excluded from this analysis. The data come from a larger study of US–MRI agreement across all pelvic sites; the present analysis addresses a separate question and is restricted to women with leiomyomas.

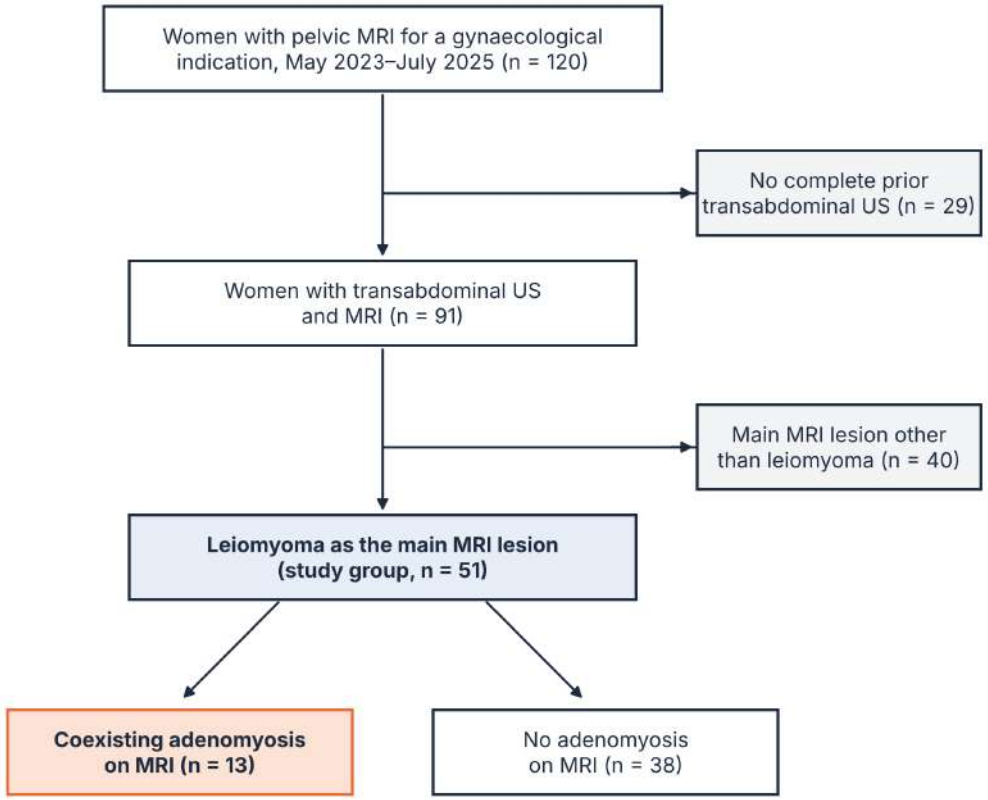


Figure 1. Flow diagram of the study population

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Imaging protocols: MRI was performed on a 1.5-T scanner (GE Optima MR450w; GE HealthCare, Milwaukee, WI, USA) with a phased-array torso coil. The protocol comprised T2-weighted fast spin-echo images in the sagittal, axial and coronal planes, axial T1-weighted images with and without fat suppression, axial diffusion-weighted imaging with apparent diffusion coefficient maps, and contrast-enhanced fat-suppressed T1-weighted images after intravenous gadoteric acid (0.1 mmol/kg). US was performed on a GE Logiq E10S unit using a transabdominal approach according to the departmental protocol.

Image interpretation and definitions: Examinations were reported in routine practice by radiologists with more than 10 years of experience in gynaecological imaging; US and MRI of the same patient were reported by different radiologists, and no images were re-read for this study. The main MRI lesion and any additional findings were taken from the MRI report. Coexisting adenomyosis was defined as adenomyosis reported on MRI as an additional finding in a woman whose main lesion was a leiomyoma. Adenomyosis was diagnosed on MRI from a thickened or ill-defined junctional zone, with or without small T2-bright or T1-bright foci, as described in the reports. US was considered to have reported adenomyosis when the term appeared in the US diagnosis. Referral indications were grouped as known or suspected leiomyoma or uterine mass, menstrual symptoms (heavy or abnormal bleeding, or dysmenorrhoea), pain, ovarian or adnexal cyst or mass, and other.

Ethical approval: The Jazan Health Cluster Research Ethics Committee approved the study (approval No. 2461), and the study was conducted in accordance with the Declaration of Helsinki. Because of the retrospective design, the committee waived the requirement for informed consent, and all data were anonymized before analysis.

Statistical analysis: Continuous variables are presented as mean ± standard deviation, and categorical variables as frequencies and percentages. Proportions are reported with exact Clopper–Pearson 95% confidence intervals. We compared age between groups using the Mann–Whitney U test because it was not normally distributed (Shapiro–Wilk $p < 0.001$). We compared categorical variables using Fisher's exact test and estimated the odds ratio by conditional maximum likelihood. Agreement between US and MRI for coexisting adenomyosis was assessed using observed agreement, Cohen's kappa (κ), the prevalence-adjusted bias-adjusted kappa (PABAK), and the exact McNemar test [13,14]. MRI was the reference; because there was no histopathology, the results describe agreement between the two tests, not diagnostic accuracy. We considered $p < 0.05$ significant. Analyses were performed in R version 4.5.1.

3. RESULTS

Study group: Of the 91 women with both examinations, 51 had a leiomyoma as the main MRI lesion (Figure 1). Their mean age was 44.1 ± 9.5 years (range 26–79).

Frequency of coexisting adenomyosis: Thirteen of the 51 women (25.5%; 95% CI 14.3–39.6) had coexisting adenomyosis on MRI. This frequency was close to that reported at histopathology in Saudi women who underwent hysterectomy with leiomyomas (Figure 2).

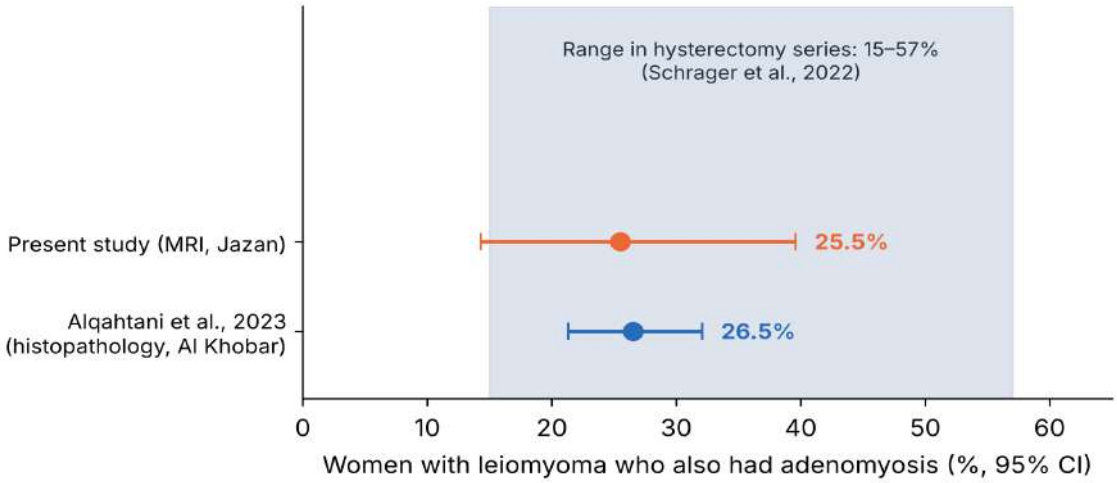


Figure 2. Frequency of coexisting adenomyosis compared with previous reports

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Present study: MRI, women with leiomyoma as the main lesion (13/51). Alqahtani et al. [10]: histopathology, hysterectomy specimens with leiomyoma (72/272); 95% CI calculated from the published counts. Shaded band: range in hysterectomy series [2].

Clinical features: Age did not differ between women with and without coexisting adenomyosis (43.2 ± 5.7 vs 44.4 ± 10.5 years; p = 0.72). Women with coexisting adenomyosis were more often referred for menstrual symptoms (5/13, 38.5% vs 4/38, 10.5%; p = 0.036; odds ratio 5.09, 95% CI 0.88–32.35) and less often for a known or suspected leiomyoma (38.5% vs 68.4%) (Table 1, Figure 3).

Table 1. Women with a leiomyoma as the main MRI lesion, by coexisting adenomyosis (n = 51)

Characteristic	Adenomyosis (n = 13)	No adenomyosis (n = 38)	p
Age, years, mean ± SD	43.2 ± 5.7	44.4 ± 10.5	0.72
Referral indication, n (%)			
Known or suspected leiomyoma / uterine mass	5 (38.5)	26 (68.4)	
Menstrual symptoms (bleeding or dysmenorrhoea)	5 (38.5)	4 (10.5)	0.036*
Ovarian or adnexal cyst or mass	2 (15.4)	3 (7.9)	
Pain	1 (7.7)	4 (10.5)	
Other	0	1 (2.6)	

**Fisher's exact test, menstrual symptoms vs all other indications. Age: Mann–Whitney U test*

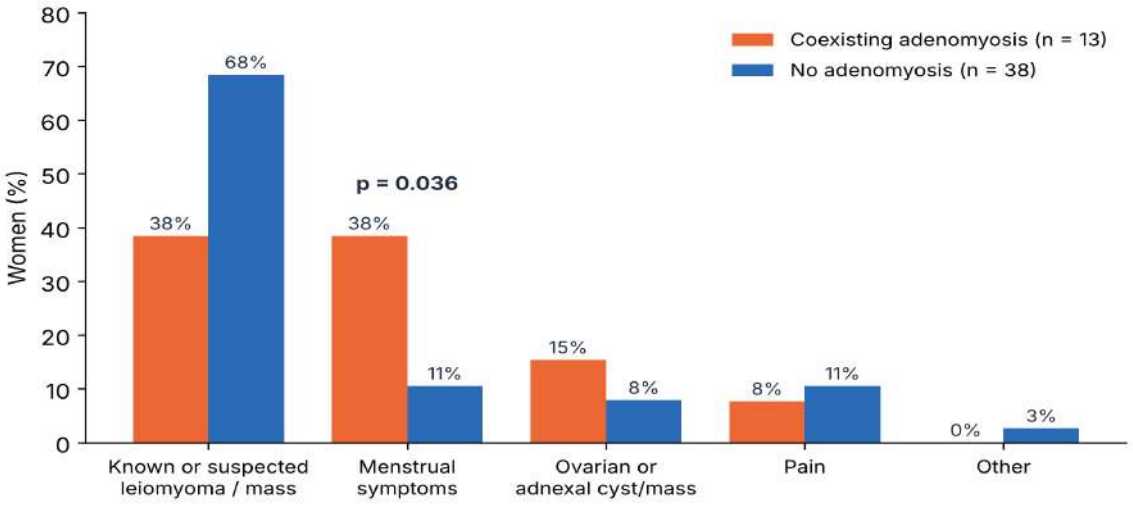


Figure 3. Referral indications in women with and without coexisting adenomyosis

Menstrual symptoms = heavy or abnormal bleeding, or dysmenorrhoea. p: Fisher's exact test, menstrual symptoms vs all other indications.

Agreement between US and MRI: Transabdominal US did not report adenomyosis in any of the 13 women (0/13; 95% CI 0–24.7). It reported a leiomyoma in 11 and an ovarian or adnexal cyst in 2 (Figure 4). Observed agreement was 74.5% (38/51), but κ was 0.00 because US never reported adenomyosis (PABAK = 0.49). All 13 discordant pairs were in the same direction, adenomyosis on MRI but not on US (exact McNemar p < 0.001) (Table 2). In every case, coexisting adenomyosis was therefore a finding added by MRI.

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Table 2. Agreement between transabdominal US and MRI for coexisting adenomyosis (n = 51)

	MRI: adenomyosis	MRI: no adenomyosis	Total
US: adenomyosis	0	0	0
US: no adenomyosis	13	38	51
Total	13	38	51

Observed agreement 74.5%; κ = 0.00; PABAK = 0.49; exact McNemar p < 0.001. In the 13 women with adenomyosis on MRI, US reported a leiomyoma (11), an ovarian cyst (1) or an adnexal cyst (1).

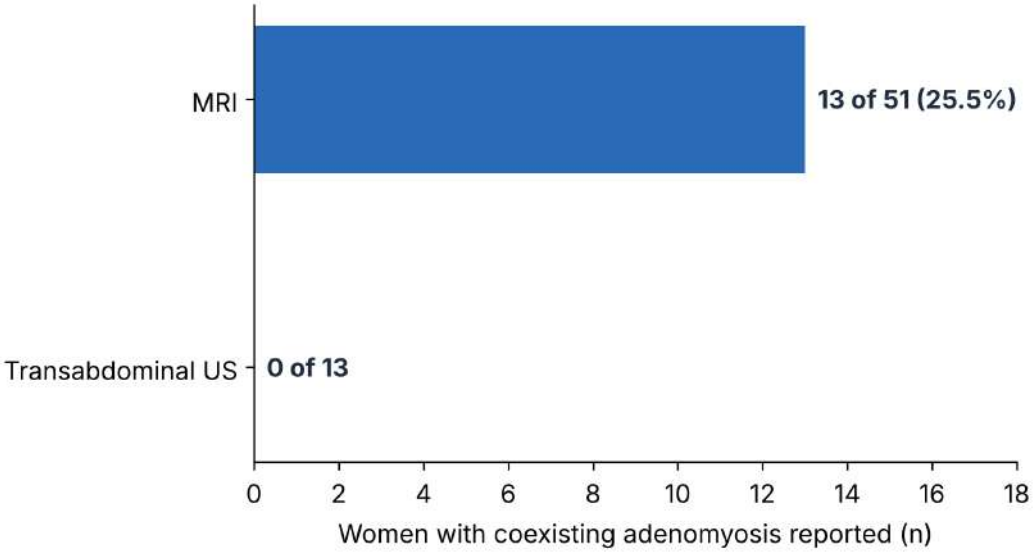


Figure 4. Coexisting adenomyosis reported on MRI and on transabdominal US

In the 13 women with coexisting adenomyosis on MRI, transabdominal US reported a leiomyoma (11), an ovarian cyst (1) or an adnexal cyst (1).

Illustrative case: A 42-year-old woman was referred for menorrhagia. Transabdominal US showed a bulky, heterogeneous uterus and gave no specific diagnosis (Figure 5A). Pelvic MRI showed a diffusely enlarged uterus with a thick junctional zone containing small T2-bright foci (Figure 5B) and a diffusely enhancing myometrium (Figure 5C), diagnostic of adenomyosis. MRI therefore changed the US diagnosis. The case illustrates the two main findings of this study: the presentation with heavy menstrual bleeding, and an abnormality of the junctional zone that transabdominal US could not show.



Figure 5. Illustrative case: adenomyosis on transabdominal US and MRI

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Illustrative case: 42-year-old woman referred for menorrhagia. (A) Transabdominal US: bulky, heterogeneous uterus without a specific diagnosis. (B) Axial T2-weighted MRI: thick junctional zone with small bright foci. (C) Axial contrast-enhanced T1-weighted MRI: diffusely enlarged uterus. Arrows indicate the lesion. Diagnosis from the MRI report, not confirmed by histopathology.

4. DISCUSSION

In this study, one in four women whose main MRI lesion was a leiomyoma also had adenomyosis, and none of these cases had been reported on the preceding transabdominal US. Agreement between the two tests for coexisting adenomyosis was no better than chance ($\kappa = 0.00$), and all disagreements were in one direction. Women with coexisting adenomyosis were more often referred for menstrual symptoms, which suggests a simple clinical clue for selecting women for MRI.

The frequency of coexisting adenomyosis in our cohort (25.5%) is close to the 26.5% (72 of 272) found at histopathology in Saudi women who underwent hysterectomy for leiomyomas [10] and lies within the 15–57% reported in hysterectomy series [2]. This agreement with a surgical series from another Saudi region supports the plausibility of the MRI findings, although the two populations differ in age and indication.

The failure of transabdominal US to detect adenomyosis is consistent with previous work. In a histopathological study, the sensitivity for adenomyosis was 32.5% for transabdominal US, 65.0% for transvaginal US and 77.5% for MRI. Sonographic sensitivity was lower when leiomyomas were also present [4]. Systematic reviews have confirmed that MRI is more specific than US for adenomyosis [5,6]. Two mechanisms probably explain our finding. First, the transabdominal route cannot resolve the junctional zone, the key structure for diagnosing adenomyosis. Second, when a leiomyoma is present, uterine enlargement and heterogeneity tend to be attributed to the leiomyoma alone. In two women, US described the leiomyoma itself as an ovarian or adnexal cyst, highlighting how challenging pelvic anatomy can be on transabdominal scanning. Studies from Riyadh have similarly shown that US has limited ability to characterise uterine lesions and their degeneration [11,12].

The association between coexisting adenomyosis and menstrual symptoms is clinically useful. When a woman with presumed leiomyomas reports heavy bleeding or dysmenorrhoea, adenomyosis should be suspected and MRI performed before uterus-sparing treatment, in line with ESUR guidance [3]. Recognising adenomyosis before myomectomy or embolisation helps set realistic expectations and select the most appropriate treatment. The confidence interval for the odds ratio was wide and included 1, so this association should be confirmed in larger studies.

These findings also have implications for reporting. Because transabdominal US did not mention adenomyosis in any case, a negative US report should not be taken to exclude it. When transvaginal scanning is possible, the MUSA features should be assessed systematically [8]; when it is not, MRI is the appropriate test before treatment. Structured US and MRI reports that require an explicit statement about the junctional zone and adenomyosis could reduce under-reporting.

Strengths and limitations: The study included consecutive women from routine practice. Both examinations were available for every woman in the study group, and agreement was quantified using kappa, PABAK and McNemar's test. To our knowledge, it is the first Saudi study to examine coexisting adenomyosis in women with leiomyomas on MRI and its detection on US. The study also has limitations. The women were referred for MRI, so the figures reflect frequency in a referred population rather than population prevalence. The number of women with coexisting adenomyosis was small, so the estimates are imprecise. MRI was the reference without histopathology; in a surgical series, MRI identified both conditions in only 9 of 23 uteri with coexisting leiomyoma and adenomyosis [15], so the true frequency of coexisting adenomyosis in our cohort may be higher. Only transabdominal US was available, and transvaginal US with MUSA criteria would probably detect more cases. We extracted data from routine reports, MRI readers were not blinded to the US report, and we did not grade the extent or type of adenomyosis.

5. CONCLUSION

About one in four women with a leiomyoma on MRI had coexisting adenomyosis, and transabdominal US reported none of these cases ($\kappa = 0.00$). Women with coexisting adenomyosis were more often referred for menstrual symptoms. MRI should be considered before uterus-sparing treatment of presumed leiomyomas, particularly in women with heavy bleeding or dysmenorrhoea, and a negative transabdominal US should not be taken to exclude adenomyosis.

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sDECLARATIONS

Ethics approval and consent: Jazan Health Cluster Research Ethics Committee, approval No. 2461; informed consent was waived because of the retrospective design.
Funding: None.
Conflicts of interest: The authors declare no conflicts of interest.
Data availability: The anonymized data and R code are available from the corresponding author on reasonable request.

Author contributions:

Sawsan Saidahmed: conceptualization, analysis and writing of the original draft. Asma Ebrahim and Muna Ahmed Ali: supervision, review and editing. Awadia Gareeballah: ultrasound expertise, review of the agreement analysis and critical revision. Ali A. Kharazi and Eassa I. Shaeri: data collection and verification of the imaging reports. Ikhlas Abdelaziz: scientific advice, interpretation of the findings and critical revision of the manuscript. All authors approved the final manuscript.

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