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REVIEW PAPER / GYNECOLOGY

Prevalence of adenomyosis in adolescents: diagnostic process and symptoms. Systematic review

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ABSTRACT

Background: Adenomyosis is a uterine disorder commonly associated with painful menstrual cycles, abnormal uterine bleeding, and dyspareunia, which can significantly impact fertility, pregnancy outcomes and overall quality of life. Recent literature reports suggest that adenomyosis is increasingly being identified in adolescents, particularly in those presenting with severe dysmenorrhea and heavy menstrual bleeding. In this review we evaluate the frequency of adenomyosis diagnosis on imaging studies in relation to the occurrence of dysmenorrhea, pelvic pain and heavy menstrual bleeding (HMB).

Methods: A thorough literature search was performed using PubMed, EMBASE and SCOPUS databases. It was confined to articles published from 1 January 2019, to 1 August 2024 and included only those available in English. Due to the very limited number of publications on this topic, an age range of 12–25 years was selected as the inclusion criteria. For articles that met the inclusion criteria, information regarding diagnosis on imaging and relation to the occurrence of symptoms was extracted.

Results: Five full-text articles were reviewed. Studies including adolescents and young women from 12–25 years of age who presented with HMB, pelvic pain, dysmenorrhea and an imaging-based diagnosis of adenomyosis. The prevalence of adenomyosis in this population ranged from 25 to 45%. It is crucial to consider adenomyosis in the differential diagnosis of adolescent girls presenting with dysmenorrhea, heavy menstrual bleeding, and pelvic pain. Dysmenorrhea was the most frequently reported symptom (from 81 to 100%) associated with imaging features of adenomyosis.

Keywords: adenomyosis; adolescent; ultrasound; MRI; pelvic pain; HMB

BACKGROUND

Introduction

Adenomyosis is a gynecological disorder commonly associated with painful menstrual cycles, abnormal uterine bleeding, and dyspareunia, which can significantly affect fertility, pregnancy outcomes and overall quality of life [1]. While it is commonly observed in women of reproductive age, however it is increasingly being diagnosed in adolescents, particularly those experiencing severe dysmenorrhea and heavy menstrual bleeding. Early diagnosis and management are crucial for enhancing the quality of life. The exact demographics and prevalence of adenomyosis remain uncertain, largely due to historical underreporting and underdiagnosis. However, advancements in ultrasound and MRI diagnostics have improved the ability to identify and understand the affected populations [2].

Adenomyosis affects approximately 20 to 35 % of women [2]. Recent studies focusing on adolescent and young women aged 12 to 25 years who experience dysmenorrhea indicate a higher prevalence rate, around 45% [3, 4, 20]. Despite these findings, the current statistical data on adenomyosis in this demographic remains limited, highlighting the need for further research to better understand the condition’s impact and progression in younger populations.

THEORIES ON THE MECHANISM OF ADENOMYOSIS

Adenomyosis is caused by estrogen-dependent growth of endometrial glands and stroma within the myometrium. This process leads to reactive hypertrophic and/or proliferative changes occurring within the myometrium, resulting in the enlargement of the uterus [1]. Adenomyosis is closely related to endometriosis, but they possess distinct characteristics. Endometriosis is characterized by the presence of endometrial tissue outside the uterine cavity, typically on the pelvic organs, peritoneum, or even more distant sites. The primary difference between adenomyosis and endometriosis lies in the location and origin of the ectopic endometrial tissue [19]. In adenomyosis, this tissue infiltrates directly into the myometrium [5]. There are cases where patients exhibit both adenomyosis and endometriosis, suggesting a potential overlap or shared pathophysiological mechanisms between the two conditions. Nevertheless, each condition can also manifest independently, affecting patients differently in terms of symptoms, severity, and response to treatment.

Several theories exist regarding the development of adenomyosis. One concept suggests the invagination of the basal endometrium into the myometrium (endometrial elements penetrate between the fibers of the muscular membrane of the postpartum uterus, often traumatized by the previous childbirth, which leads to hyperplasia and hypertrophy of the surrounding smooth muscle cells). Another theory proposes de novo development due to the metaplasia of embryonic Mullerian ducts or endometrial stem/progenitor cells along with the myometrium [6]. Other researchers hypothesize that the retrograde infiltration of endometrial cells into the uterine wall from the serosal side during menstruation may contribute to adenomyosis development [7]

Research indicates that multiple pathways are involved in the inflammatory process associated with adenomyosis, including tissue damage, particularly at the junction of the endometrium and myometrium, and local estrogen production, which may induce adenomyotic changes [6].

DIAGNOSTIC PROCESS OF ADENOMYOSIS

Diagnosis adenomyosis is challenging, as it relies on clinical suspicion based on patient — reported symptoms and imaging findings .It was primarily diagnosed through histopathological examination, but after the introduction modern imaging techniques such as transvaginal ultrasounds (TVS) and magnetic resonance imagining (MRI), it can be identified

with noninvasive and greater accuracy. Notably, there are no specific physical examination findings or laboratory parameters that definitively diagnose adenomyosis [8].

Transvaginal ultrasonography (TVUS) and magnetic resonance imagining (MRI) are currently the main radiologic tools for diagnosing this condition, with the diagnostic accuracy rates of 91% and 85 %, respectively [9]. In the ultrasound assessment of sexually inactive adolescents, a transrectal ultrasonography (TRS) approach achieves similar diagnostic value. The ultrasound diagnosis of adenomyosis should adhere to the Morphological Uterus Sonographic Assessment (MUSA) criteria and be conducted by an experienced ultrasonographer. It is crucial to differentiate between direct and indirect features. Direct features are associated with the presence of ectopic endometrial tissue within the myometrium, while indirect features occur secondary to the presence of this tissue, such as myometrial hypertrophy (resulting in a globular uterus) or imaging artifacts (like shadowing) [9].

The basis of adenomyosis diagnosing is the detection of ectopic endometrial tissue within the myometrium [10]. In sonography, the uterine body is often enlarged, sometimes assuming globular shape. This enlargement can be diffuse or focal, manifesting as nodules within the uterine wall, typically in the posterior part. Additionally, small glandular cysts are often observed in younger women. The enlargement is primarily due to the hypertrophy or hyperplasia of the smooth muscle tissue. [10, 11] Additionally, the assessment includes examining the junctional zone (JZ) between the endometrium and the myometrium, which may appear irregular, poorly defined, disrupted, or even absent. Adenomyosis is categorized as localized if the affected myometrium occupies less than 50% of the uterine volume, and as diffuse if it involves more than 50% [12].

Studies indicate that TVUS is the primary imaging tool for diagnosing adenomyosis and has a diagnostic value comparable to MRI. However, some research suggests that MRI-based classification is necessary to enhance the objectivity, reproducibility, and interpretability of TVUS findings. The current MRI classification includes five categories: affected area (internal or external adenomyosis); pattern (diffuse or focal); size or volume (involvement of the myometrium < 1/3, < 2/3, or > 2/3 of the uterine wall); presence of coexisting pathologies (including peritoneal endometriosis, ovarian endometriosis, deep infiltrating endometriosis (DIE), uterine fibroids, or others); location (anterior, posterior, or fundal) [13].

This classification offers a comprehensive evaluation of the disease, aiding in the standardization of diagnosis and interpretation of MRI findings in patients with adenomyosis.

REVIEW

Methods

This systematic review was conducted in accordance with The Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines [14].

Literature search and inclusion criteria

The literature review was performed using the PubMed, SCOPUS and EMBASE database focusing on terms “adenomyosis” and “adolescents” OR “adolescence”.

The search was restricted to articles published between 2019/01/01 to 2024/08/01 and limited to publications in the English language. A total of 54 publications were identified. Editorials, case reports, review, as well as those including only adult populations, were excluded from this review. Due to the very limited number of publications on this topic, an age range of 12–25 years was selected as the inclusion criteria (Tab 1.).

Table 1. Inclusion and exclusion criteria:

I.	**Include terms “adenomyosis” and “adolescents” OR “adolescence”**
II.	**Include age range 12–25 years**
III.	**Not a report with only adults**
IV.	**Not a case reports**
V.	**Not a review article**
VI.	**Filter language: English**

RESULTS

Figure 1 illustrates the outcomes of the systematic review. The database searches provide a total of 54 results. Following the abstract that excluded after screening titles a total of 12 full-text articles were found. Articles excluded that did not meet inclusion criteria.

Forty-nine articles were excluded: 14 adult population studies, 28 not relevant to the subject under discussion, 6 case reports, 1 full texts not available. A Total of 5 studies met inclusion criteria and were analyzed for this study.

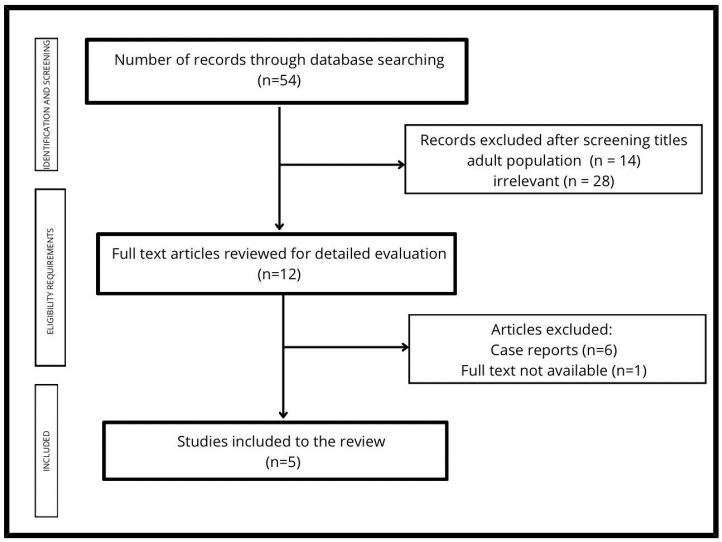

Figure 1. Literature search results [14]

STUDY CHARACTERISTICS

Ultrasound findings and symptoms

The diagnosis of adenomyosis using ultrasonography based on characteristic features demonstrated an accuracy of up to 91%, and gave a chance to detect and evaluate it even in adolescents. According to the Morphological Uterus Sonographic Assessment (MUSA) criteria adenomyosis can be suspected when the sonographic features are identified: asymmetrical thickening of the myometrium, presence of myometrial cysts, linear striations, hyperechoic islands, irregular junctional zone (JZ). The diagnosis of adenomyosis should be particularly considered in adolescent girls who present symptoms such as: abnormal menstrual bleeding, dysmenorrhoea, HMB or pelvic pain [12].

Vannuccini et al. [15] conducted a study involving 95 patients aged between 13 and 25 years, all presenting with dysmenorrhea and/or heavy menstrual bleeding. The study population underwent transvaginal ultrasound (TVUS) for evaluation. Based on the Morphological Uterus Sonographic Assessment (MUSA) criteria, 27.4% of these patients were diagnosed with adenomyosis. The findings indicate that adolescent girls with heavy

menstrual bleeding, particularly those with concurrent dysmenorrhea, were more likely to exhibit ultrasound features suggestive of adenomyosis.

In a 2022 study, Exacoustos et al. [4] assessed the type and grade of adenomyosis on ultrasound examination and the correlation with clinical symptoms in a group of 43 adolescents with ultrasonographic features of adenomyosis. The most frequently reported symptom was dysmenorrhea, occurring in 88% of cases. This was associated with adenomyosis of the outer myometrium, hyperechogenic areas within the myometrium, uterine wall asymmetry, and intramyometrial cystic areas. Further evaluation revealed that heavy menstrual bleeding was also common in this population, affecting 53% of the participants. Gastrointestinal symptoms were observed less frequently in 20% of the cases [4].

Recent literature report investigated a cohort of 100 females aged between 14 and 24 years who presented with chronic pelvic pain. The study found that adenomyosis was present in 46% of these patients. Furthermore, the study compared the prevalence of adenomyosis between two subgroups: adolescents aged 14–19 years and young adults aged 20–24 years. The results indicated that features of adenomyosis were more commonly observed in the older age group (56%) compared to the younger group (37%). This suggests that while adenomyosis is more prevalent in older individuals but it can originate during adolescence. These findings highlight the importance of early recognition and evaluation of adenomyosis in adolescent girls presenting with chronic pelvic pain, as it may contribute to better management and outcomes for those affected by this condition [3].

Table 2. Summarizes the data extracted from the 4 studies. It includes information on the prevalence of specific symptoms and the prevalence of adenomyosis with features in the US in association with these symptoms

First Author	**Year Published**	**No. Of patients**	**Symptoms**	**Percentage of patient with adenomyosis features in US (%)**

Exacoustos [4]	2022	43* *all patients included in the study had adenomyosis diagnosed in an ultrasound examination	–Dysmenorrhea (88.4%) –HMB (53.5 %) –Bowel symptoms (20%)	100%
Zannoni [3]	2020	100	–Chronic pelvic pain (100%)	46%
Vannuccini [15]	2024	95	–Dysmenorrhea (88.4%) -HMB (23%)	27.4%
Martire [16]	2020	270	–Dysmenorrhea (81%) –HMB (68%)	6%

MRI findings and symptoms

The diagnosis of adenomyosis using magnetic resonance imaging (MRI) relies on the identification of characteristic imaging features such as myometrial thickening, the presence of myometrial cysts, hypointense striations, and an ill-defined junctional zone. These features help differentiate adenomyosis from other uterine conditions and provide a non-invasive means of assessing the extent of the disease [17].

In a 2022 study involving a cohort of 345 girls aged between 12 and 20 years, the prevalence of endometriosis and its characteristics were evaluated using magnetic resonance imaging (MRI). During this study, features of adenomyosis were observed in 12% of patients presenting with severe and painful menstruation. While further research is necessary to fully understand the implications of these findings, this study suggests that adenomyosis should not be considered solely a condition affecting adult women but should also be recognized as a possible diagnosis in adolescent girls [18].

Table 3. summarizes the data extracted from the 1 study. It includes information on the prevalence of specific symptoms and the prevalence of adenomyosis with features in the MRI in association with these symptoms

First Author	Year Published	No. Of patients	Symptoms	Percentage of patient with adenomyosis features in MRI [%]
Millischer [18]	2023	345	–Severe dysmenorrhea (100%)	12%

DISCUSSION

Analyzing the above studies, an integrated approach to the diagnosis of adenomyosis is crucial. A clinical diagnosis can be made by correlating symptoms with imaging findings. In sexually active girls, transvaginal ultrasound (TVUS) should be considered the method of choice for diagnosis. For adolescent girls who are not sexually active, transrectal sonography (TRS) or magnetic resonance imaging (MRI) are more appropriate options. The assessment of adenomyotic changes should adhere to the Morphological Uterus Sonographic Assessment (MUSA) criteria to ensure consistency and accuracy in diagnosis. Data from the literature review suggest that the prevalence of adenomyosis in young girls ranges from 25% to 45%. Therefore, it is important not to overlook symptoms suggestive of this condition in this population. However, further studies are needed to establish more accurate statistics and to better understand the presentation and progression of adenomyosis in adolescents.

CONCLUSION

Adenomyosis is a condition more frequently diagnosed in adult women, than in adolescence. However, recent studies have indicated that adenomyosis can also occur in younger patients, challenging the previous understanding of the age range affected by this condition. This evolving knowledge highlights the importance of recognizing adenomyosis as a potential cause of menstrual and pelvic symptoms in younger populations. Advances in imaging techniques, such as transvaginal ultrasound (TVUS) and magnetic resonance imaging (MRI), have greatly improved the ability to detect adenomyosis in adolescent girls.

It is important to take under consideration adenomyosis in the differential diagnosis of adolescent girls presenting with dysmenorrhea, heavy menstrual bleeding, and chronic pelvic pain. These symptoms, although commonly associated with other conditions like endometriosis, may also indicate the presence of adenomyosis. Early and accurate diagnosis through imaging can lead to more effective management and improve the quality of life of young patients. However, the current knowledge about adenomyosis in adolescents is still limited and further research is necessary to establish precise guidelines for this condition in young girls. Expanding the scope of research will not only increase diagnostic accuracy but also contribute to the development of more targeted and effective treatments. Despite the advances in imaging and diagnosis, the current understanding of adenomyosis in adolescents remains incomplete. Further research is necessary to gain deeper insights into the prevalence, risk factors, and optimal treatment approaches for adenomyosis in younger populations. Such research could inform the development of clinical guidelines specifically tailored to adolescents, helping healthcare providers make informed decisions about diagnosis and treatment.

In conclusion, while adenomyosis has traditionally been viewed as a condition affecting adult women, increasing evidence suggests it can also affect adolescent girls. Thanks to improved imaging techniques, healthcare providers are now better equipped to detect this condition in younger patients. It is vital that adenomyosis be considered in the differential diagnosis of adolescents with menstrual irregularities and pelvic pain to ensure early diagnosis and effective management. Continued research into adenomyosis in adolescents will be key to developing more precise guidelines and treatment strategies, ultimately improving outcomes for young patients with this condition.

References

1. Bergeron C, Amant F, Ferenczy A. Pathology and physiopathology of adenomyosis. Best Pract Res Clin Obstet Gynaecol. 2006; 20(4): 511–521, doi: 10.1016/j.bpobgyn.2006.01.016, indexed in Pubmed: 16563870.
2. Upson K, Missmer SA. Epidemiology of Adenomyosis. Semin Reprod Med. 2020; 38(2-03): 89–107, doi: 10.1055/s-0040-1718920, indexed in Pubmed: 33105509.
3. Zannoni L, Del Forno S, Raimondo D, et al. Adenomyosis and endometriosis in adolescents and young women with pelvic pain: prevalence and risk factors. Minerva

Pediatr (Torino). 2024; 76(1): 57–63, doi: 10.23736/S2724-5276.20.05842-9, indexed in Pubmed: 32549030.

4. Exacoustos C, Lazzeri L, Martire FG, et al. Ultrasound Findings of Adenomyosis in Adolescents: Type and Grade of the Disease. J Minim Invasive Gynecol. 2022; 29(2): 291–299.e1, doi: 10.1016/j.jmig.2021.08.023, indexed in Pubmed: 34464760.
5. Donnez O, Orellana R, Van Kerk O, et al. Invasion process of induced deep nodular endometriosis in an experimental baboon model: similarities with collective cell migration? Fertil Steril. 2015; 104(2): 491–7.e2, doi: 10.1016/j.fertnstert.2015.05.011, indexed in Pubmed: 26049053.
6. Khan KN, Kitajima M, Hiraki K, et al. Involvement of hepatocyte growth factor-induced epithelial-mesenchymal transition in human adenomyosis. Biol Reprod. 2015; 92(2): 35, doi: 10.1095/biolreprod.114.124891, indexed in Pubmed: 25505196.
7. Zhai J, Vannuccini S, Petraglia F, et al. Adenomyosis: Mechanisms and Pathogenesis. Semin Reprod Med. 2020; 38(2-03): 129–143, doi: 10.1055/s-0040-1716687, indexed in Pubmed: 33032339.
8. Schrager S, Yogendran L, Marquez CM, et al. Adenomyosis: Diagnosis and Management. Am Fam Physician. 2022; 105(1): 33–38, indexed in Pubmed: 35029928.
9. Harmsen MJ, Van den Bosch T, de Leeuw RA, et al. Consensus on revised definitions of Morphological Uterus Sonographic Assessment (MUSA) features of adenomyosis: results of modified Delphi procedure. Ultrasound Obstet Gynecol. 2022; 60(1): 118–131, doi: 10.1002/uog.24786, indexed in Pubmed: 34587658.
10. Bergeron C, Amant F, Ferenczy A. Pathology and physiopathology of adenomyosis. Best Pract Res Clin Obstet Gynaecol. 2006; 20(4): 511–521, doi: 10.1016/j.bpobgyn.2006.01.016, indexed in Pubmed: 16563870.
11. Brosens I, Gordts S, Habiba M, et al. Uterine Cystic Adenomyosis: A Disease of Younger Women. J Pediatr Adolesc Gynecol. 2015; 28(6): 420–426, doi: 10.1016/j.jpag.2014.05.008, indexed in Pubmed: 26049940.
12. Van den Bosch T, Dueholm M, Leone FPG, et al. Terms, definitions and measurements to describe sonographic features of myometrium and uterine masses: a consensus opinion from the Morphological Uterus Sonographic Assessment (MUSA) group. Ultrasound Obstet Gynecol. 2015; 46(3): 284–298, doi: 10.1002/uog.14806, indexed in Pubmed: 25652685.
13. Celli V, Dolciami M, Ninkova R, et al. MRI and Adenomyosis: What Can Radiologists Evaluate? Int J Environ Res Public Health. 2022; 19(10), doi: 10.3390/ijerph19105840, indexed in Pubmed: 35627376.

14. Moher D, Liberati A, Tetzlaff J, et al. PRISMA Group, PRISMA Group, PRISMA Group, PRISMA Group, PRISMA Group, PRISMA Group, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA Statement. Open Med. 2009; 3(3): e123–e130, indexed in Pubmed: 21603045.
15. Vannuccini S, Meleca C, Toscano F, et al. Adenomyosis diagnosis among adolescents and young women with dysmenorrhoea and heavy menstrual bleeding. Reprod Biomed Online. 2024; 48(5): 103768, doi: 10.1016/j.rbmo.2023.103768, indexed in Pubmed: 38432071.
16. Martire FG, Lazzeri L, Conway F, et al. Adolescence and endometriosis: symptoms, ultrasound signs and early diagnosis. Fertil Steril. 2020; 114(5): 1049–1057, doi: 10.1016/j.fertnstert.2020.06.012, indexed in Pubmed: 33036795.
17. Agostinho L, Cruz R, Osório F, et al. MRI for adenomyosis: a pictorial review. Insights Imaging. 2017; 8(6): 549–556, doi: 10.1007/s13244-017-0576-z, indexed in Pubmed: 28980163.
18. Millischer AE, Santulli P, Da Costa S, et al. Adolescent endometriosis: prevalence increases with age on magnetic resonance imaging scan. Fertil Steril. 2023; 119(4): 626–633, doi: 10.1016/j.fertnstert.2022.12.039, indexed in Pubmed: 36592649.
19. Sadłocha M, Toczek J, Major K, et al. Endometriosis: Molecular Pathophysiology and Recent Treatment Strategies-Comprehensive Literature Review. Pharmaceuticals (Basel). 2024; 17(7), doi: 10.3390/ph17070827, indexed in Pubmed: 39065678.
20. Drosdzol-Cop A, Niziński K, et al. Rekomendacje Sekcji Ginekologii Dziecięcej i Dziewczęcej Polskiego Towarzystwa Ginekologów i Położników dotyczące diagnostyki i leczenia endometriozy u dziewcząt. Ginekologia i Perinatologia Praktyczna. 2024; 9(1): 26–31.