

## ORIGINAL RESEARCH

# A study of utilizing MRI for the assessment of the uterine junctional zone in the early detection of adenomyosis

<sup>1</sup>Dr. Naresh Kumar, <sup>2</sup>Dr. Mohit Threja

<sup>1</sup>Associate Professor, Department of Radiodiagnosis, Govt Medical College & Rajindra Hospital, Patiala, Punjab

<sup>2</sup>Junior Resident, Department of Radiodiagnosis, Govt Medical College & Rajindra Hospital, Patiala, Punjab

## Corresponding author

Dr. Naresh Kumar

Associate Professor, Department of Radiodiagnosis, Govt Medical College & Rajindra Hospital, Patiala, Punjab

Email: [drnaresh525@gmail.com](mailto:drnaresh525@gmail.com)

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## Abstract

**Background:** To study the importance of utilizing MRI for the assessment of the uterine junctional zone in the early detection of adenomyosis.

**Materials & Methods:** A total of 50 subjects were enrolled. The subjects were divided into two groups: a case consisting of 25 subjects with adenomyosis and a control group comprising 25 subjects without adenomyosis. Mann-Whitney U test was done. The results were analysed using SPSS software.

**Results:** In the case group, 25 subjects were enrolled. The subjects who had diffuse type of adenomyosis were 84% and rest 16% had focal type. The p-value <0.05 and was considered significant.

**Conclusion:** MRI is the preferred method for imaging and assessing the junctional zone (JZ), which serves as a crucial diagnostic indicator in diagnosing adenomyosis.

**Keywords:** MRI, junctional zone, adenomyosis.

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## Introduction

In contrast to the case of endometriosis, public health professionals and the public at large are less aware of the consequences of uterine adenomyosis. Classically, adenomyosis is defined by the presence or 'invasion' of endometrial glands and stroma within the uterine muscle. Relevant features are the depth of stromal and glandular invasion and the presence of myometrial hypertrophy or hyperplasia leading to uterine enlargement. The reported incidence in different studies varies from 5 to 70%. However, this wide variability is more likely to be related to differences in diagnostic criteria, study population or methodological differences in case ascertainment.<sup>1</sup> There is existing evidence that establishes a connection between adenomyosis and various health issues, including abnormal bleeding, painful menstruation, chronic pelvic pain, infertility, and spontaneous pregnancy loss. However, the precise characterization of the health economic impact of adenomyosis remains unclear. Adenomyosis is frequently encountered in uteri removed via hysterectomy, either as a standalone diagnosis or in combination with other conditions like fibroids.

Adenomyosis is a common benign gynaecological disorder defined as the presence of ectopic endometrial glands and stroma within the myometrium.<sup>2</sup> It is a disease of the archimetra or inner myometrium and results from infiltration of the basal endometrium into the underlying myometrium, with subsequent hypertrophy and hyperplasia of smooth muscle.<sup>3</sup> It is difficult to accurately determinate the incidence of adenomyosis since the diagnosis can only be made with certainty by microscopic examination of the uterus. Although generally estimated to affect 20% of women, the incidence was approximately 65% in one study in which meticulous histopathological analysis of multiple myometrial sections was performed.<sup>4</sup> Adenomyosis is associated with a wide spectrum of clinical manifestations, ranging from asymptomatic to disabling conditions consisting of severe dysmenorrhea, dyspareunia, menorrhagia and menometrorrhagia and may be related to concomitant conditions such as anemia.<sup>5,6</sup> The lack of awareness may be related to difficulty in obtaining a reliable diagnosis. Until recently, diagnosis was only possible through histological examination following hysterectomy. Ultrasound and MRI are now widely

available and increasingly used in clinical practice. These advances enabled non-operative assessment and renewed interest in adenomyosis and raised the prospect of better understanding of its etiology and impact.<sup>7,8</sup> The utilization of imaging for diagnosing adenomyosis in women who are not undergoing hysterectomy highlights the constraints of existing therapeutic choices and prompts the consideration that adenomyosis may represent a spectrum of diseases. The prevalence of adenomyosis in different populations remains uncertain, and our understanding of the initial stages of the condition remains constrained. Hence, this study was conducted to evaluate the importance of utilizing MRI for the assessment of the uterine junctional zone in the early detection of adenomyosis.

### Materials & Methods

A total of 50 subjects were enrolled. The subjects were divided into two groups: a case consisting of 25 subjects with adenomyosis and a control group comprising 25 subjects without adenomyosis. Magnetic resonance imaging (MRI) of the pelvis was conducted for all subjects in both groups. The

thickness of the junctional zone (JZ) was measured using specialized software in T2w sagittal sequences for all subjects, encompassing both case and control groups. In the case group, patients diagnosed with adenomyosis were further categorized into three types: diffuse, focal, or Adenomyoma, and their results were subsequently compared. Additionally, the study evaluated the presence of endometriosis and myomas in both groups, while also analyzing their coexistence with adenomyosis. Mann-Whitney U test was done. The results were analysed using SPSS software.

### Results

In the case group, 25 subjects were enrolled. The subjects who had diffuse type of adenomyosis were 84% and rest 16% had focal type. The p-value <0.05 and was considered significant. In the target group, the mean thickness of the Junctional zone (JZ) was 14.6mm with a standard deviation (SD) of 1.2mm, whereas in the control group without adenomyosis, the JZ mean thickness was 6.8mm with a SD of 1.2mm.

**Table 1: comparing thickness of junctional zone in both the groups**

		Junctional zone (mm)			
		Mean	Standard deviation	Minimum	Maximum
Group	Case	14.6	1.2	11.8	17
	Control	6.8	1.2	5.3	11.8
	Total	10.7	3.0	5.4	17

### Discussion

The development of high-resolution imaging techniques, particularly magnetic resonance (MR) imaging, has improved the preoperative diagnosis of adenomyosis. On T2-weighted MR images of the uterus, the junctional zone myometrium can be clearly distinguished from the endometrium and outer myometrium, and diffuse or focal thickening of this zone is now recognized as one hallmark of adenomyosis.<sup>9</sup> Furthermore, both MR and transvaginal ultrasound (TVU) are valuable in characterizing adenomyosis as they can identify myometrial cysts, distorted and heterogeneous myometrial echotexture and poorly defined foci of abnormal myometrial echotexture. However, the most predictive TVU finding for adenomyosis is the presence of ill-defined myometrial heterogeneity.<sup>10</sup> MR imaging offers sensitivity rates of up to 88% and specificity rates of up to 93%. Studies comparing MR and TVU offer inconclusive data, with some studies reporting equivalent results, and others report the superiority of MR imaging.<sup>11</sup> Hence, this study was conducted to evaluate the importance of utilizing MRI for the assessment of the uterine junctional zone in the early detection of adenomyosis. In the present study, in the case group, 25 subjects were enrolled. The subjects who had diffuse type of adenomyosis were 84% and rest 16% had focal type. The p-value <0.05

and was considered significant. A study by Sofic A et al, a prospective, comparative and open study. Patients with adenomyosis have been sorted in target group, n = 82, while the control group consisted of patients without adenomyosis, n = 82. All patients, from both groups have undergone a magnetic resonance imaging of the pelvis. Using a software tool for measurement, the thickness of the JZ was measured in T2w sag sequences in all patients from both groups (target and control) n = 164. Of the 82 patients in the target group, 81.7% of the patients had diffuse adenomyosis, while 18.3% had focal type with statistically significant difference (p <0.05). The results of the Mann-Whitney U test showed that p <0.05, implying that there is a statistically significant difference in the thickness of the JZ between the control and target group, therefore patients from the target group with adenomyosis had a statistically significantly thicker junctional zone than the patients in the control group. The JZ in the target group was on average M = 14,3mm, SD = 1.3mm, while the thickness of JZ in the control group without adenomyosis was M = 5,6mm, SD = 1,3. Chi-square shows that p <0.05, implying that there is a statistically significant difference in the number of patients with myomas between the two groups, where the myomas significantly over-represented in the target group with 32,9 % vs.6 %). MRI is the method

of choice for imaging and evaluation of JZ as an important diagnostic marker in the diagnosis of adenomyosis. It is important to recognize this condition as early as possible and distinguish it from other pathologies in order for timely and appropriate treatment.<sup>12</sup> In the present study, in the target group, the mean thickness of the Junctional zone (JZ) was 14.6mm with a standard deviation (SD) of 1.2mm, whereas in the control group without adenomyosis, the JZ mean thickness was 6.8mm with a SD of 1.2mm. Another study by Celli V et al, studied that adenomyosis is often related to infertility and other adverse pregnancy outcomes. Modern imaging techniques allow the non-invasive diagnosis of adenomyosis and, in this framework, Magnetic Resonance Imaging (MRI) has assumed a central role due to its high diagnostic accuracy in the detection of adenomyosis. Currently, there is still a lack of international consensus on adenomyosis diagnostic criteria and classification, despite the fact that an agreed reporting system would promote treatment outcomes and research. Their review aims to emphasize the important contribution of MRI to the diagnosis of adenomyosis and to highlight how, thanks to the great tissue differentiation provided by MRI, it is possible to identify the main direct (cystic component) and indirect (junctional zone features) signs of adenomyosis and to distinguish its various subtypes according to different MRI-based classifications. They also explored the main MRI criteria to identify the most common pitfalls and differential diagnoses of adenomyosis, whose features should be considered to avoid misdiagnosis.<sup>13</sup> Yu et al. reported on the incidence of adenomyosis among women enrolled in the Kaiser Permanente Health Plan in the State of Washington. The cohort of 333,693 women contributed 1,185,855 woman-years. The diagnosis of adenomyosis was obtained based on diagnostic coding of health episodes. Most instances were confirmed following hysterectomy. The overall incidence of adenomyosis was 1.03% (28.9 per 10,000 woman-years). However, the estimates varied from 30.6 in 2007 to a low of 24.4 per 10,000 woman-years in 2014. The difference may be related to difference in hysterectomy rates. There was an age-related trend. The highest incidence was in the 41–45 years group; 18.0% also had endometriosis and 47.6% had uterine fibroids. Adenomyosis was higher in non-Hispanic black women and less common in Asian women. The health care burden was substantial: 82.0% of women had hysterectomies, nearly 70% had imaging studies suggestive of adenomyosis and 37.6% used chronic pain medications.<sup>14</sup> Hricak et al, demonstrated the specific appearance on MRI of inner myometrial junctional zone (JZ), positioned between the endometrium and the outer myometrium, but did not link this to adenomyosis.<sup>15</sup> Lee et al. reported the identification of adenomyosis using MRI in hysterectomy specimens.<sup>16</sup> Mark et al. demonstrated the use of MRI in differentiating adenomyosis from

fibroids. It has been pointed out that histological diagnosis relies on the detection of the ectopic glandular elements within the myometrium (the ‘adenosis’ component), whereas imaging relies on aberration in the appearance of the muscle (the ‘myosis’ component).<sup>17</sup> Levgur et al. and Parazzini et al. reported that patients who had undergone pregnancy termination via dilation and curettage demonstrated higher rates of adenomyosis than women without pregnancy terminations.<sup>18,19</sup> Furthermore, Parazzini et al. and Taran et al. also observed higher rates of adenomyosis in non-pregnant patients who had undergone dilation and curettage.<sup>20,21</sup> Whitted et al. observed an increased prevalence of adenomyosis in subjects who had had prior cesarean section.<sup>22</sup> However, other studies reported no increased rates of cesarean section or any other uterine surgical procedure in women with adenomyosis.<sup>23</sup> Adenomyosis appears as diffuse or focal thickening of the junctional zone on the poorly-defined area of low signal intensity, sometimes with visible bright spots in hypersignal on T2-weighted images. Histologically, areas of low signal intensity correspond to smooth muscle hyperplasia, while bright foci on T2-weighted images correspond to the islands of ectopic endometrium tissue and cystic dilatation of glands. During menstrual bleeding within the ectopic endometrium tissue, the signal intensity on T1 images can become considerably high. Even without bleeding or treatment, the appearance of adenomyosis and the intensity of hypersignal of ectopic endometrium glands may fluctuate. There is no consistent parameter of endometrium penetration depth required for the diagnosis of adenomyosis. Most authors use the depth of penetration of the endometrium between 1-4 mm.<sup>24</sup> In most cases, endometrium glands lie substantially within the myometrium deeper than half the width or equivalent to 2.5 mm or one quarter of the JZ and are not hormone-dependent as opposed to endometriosis.<sup>25</sup>

### Conclusion

MRI is the preferred method for imaging and assessing the junctional zone (JZ), which serves as a crucial diagnostic indicator in diagnosing adenomyosis. procedure in women with adenomyosis.<sup>23</sup> Adenomyosis appears as diffuse or focal thickening of the junctional zone on the poorly-defined area of low signal intensity, sometimes with visible bright spots in hypersignal on T2-weighted images. Histologically

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