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1 **Conservative surgery for adenomyosis and results: A systematic review**

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Abstract

The traditional treatment for women with symptomatic adenomyosis is hysterectomy. However, reproductive aged women should be managed with less invasive treatments including medical treatment. For patients who are refractory or unsuitable to long term medical treatment, or those with focal adenomyoma, conservative surgeries could be offered. The objective of our study was to review available conservative surgeries for the treatment of adenomyosis, their complications, and the rates of success and recurrence. In this systematic review, we evaluated 27 studies; 10 prospective and 17 retrospective studies including a total of 1398 patients. The results showed that excision of adenomyosis is effective for symptom-control such as menorrhagia and dysmenorrhea, and most probably for adenomyosis-related infertility. For preserving fertility and relieving symptoms, medical treatment is usually the first choice; whereas excisional surgery could be performed for refractory adenomyosis. The results show that over three quarter of women will experience symptom relief after conservative surgery. The pregnancy rates after conservative surgical treatment vary widely. However, three quarter of them conceived after surgery with or without adjuvant medical treatment. Depending on the duration of follow-up, recurrence rates differ from no recurrence to almost a half of the patients. Conservative surgery for adenomyosis improves pelvic pain, abnormal uterine bleeding and possibly fertility. The best method of surgery is yet to be seen.

41

Key words: adenomyosis, adenomyomectomy, excision, conservative surgery, laparoscopy.

43

44 **Introduction**

45 Adenomyosis is a common benign disorder characterized by ectopic endometrial glands
46 and stroma within the myometrium (1-4). It can be diffuse where foci of endometrial glands
47 scatter throughout the myometrium, or less commonly focal where the adenomyosis presents as
48 “adenomyoma”, a circumscribed nodule of hypertrophic and distorted endometrium within the
49 myometrium (5, 6). Less common types are juvenile cystic adenomyoma, typically in women
50 younger than 30 years (7, 8), and polypoid adenomyoma. The latter is composed of endometrioid
51 glands and a stromal component predominantly of smooth muscle, with or without structural and
52 cellular atypia (9-11). The ectopic endometrial tissue induces hypertrophy and hyperplasia of the
53 surrounding myometrium, resulting in a diffusely enlarged uterus (12).

54 Typical symptoms of adenomyosis are dysmenorrhea, menorrhagia, chronic pelvic pain,
55 or infertility (13). Traditionally, the diagnosis is established by histopathology of the uterine
56 specimen (Fig. 1). Today, the diagnosis could be made with a high level of accuracy by magnetic
57 resonance imaging (MRI) and high quality transvaginal sonography (TVS) (14-16).

58 The conventional treatment for women with symptomatic adenomyosis has been
59 hysterectomy. However, reproductive aged women should be managed with less invasive
60 treatments including medical treatment with prostaglandin inhibitors, oral contraceptives,
61 progestogens or gonadotropin releasing hormone agonist (GnRHa). Those treatments are
62 temporary and accompanied by side effects (17-19). For patients who are refractory or unsuitable
63 to long term medical treatment, or those with focal adenomyoma, conservative surgeries could
64 be offered. These include adenomyomectomy with or without myometrial reduction,
65 endomyometrial ablation or resection, electrocoagulation of adenomyoma, and myometrial

66 excision. Excision of extensive adenomyosis is difficult and associated with a high recurrence
67 rate (19-21).

68 The objective of our study was to review available conservative surgeries for the
69 treatment of adenomyosis, their complications, and the rates of success and recurrence.

70

71 **Search strategy**

72 We conducted an electronic based search using Pubmed, Embase, Ovid Medline,
73 Cochrane Central Register of Controlled Trials Medline and Google Scholar. The following
74 medical terms, keywords, and their combinations were used: “adenomyosis surgical treatment”,
75 “adenomyosis conservative surgery”, “uterine sparing surgery”, “adenomyomectomy”, “diffuse
76 adenomyosis treatment”, “focal adenomyosis treatment”, “juvenile cystic adenoma”. The search
77 was limited to full length manuscripts published in English language in peer reviewed journals,
78 up to March 2017. The reference lists of all included articles and relevant reviews were reviewed
79 in search for other relevant articles.

80

81 **Selection criteria**

82 Reports of women who were found to have a uterine sparing surgery for adenomyosis
83 were reviewed. We excluded review articles, case reports and video reports. Two authors (GY
84 and TT) assessed each article independently. A third researcher was not needed due to lack of
85 discrepancy. The review was made in accordance with the PRISMA (Preferred Reporting Items
86 for Systematic Reviews and Meta-Analyses) statement (Fig. 2).

87 All articles were analyzed and the following data were recorded: year of publication,
88 study design, study population, number of patients, diagnostic method, surgical technique, effect

89 on symptoms after surgery, pregnancy rate and miscarriage rate after surgical treatment if
90 applicable, and complications. Methodological quality assessment of non-randomized studies
91 was made for potential risk of bias using the Cochrane Collaboration's Risk of Bias Tools for
92 Non-Randomized Studies (Table 1). Because the term diffuse adenomyosis might represent
93 involvement of the entire uterus that is not feasible to be excised completely, we use the term
94 extensive adenomyosis.

95

96 **Surgical procedures**

97 Uterine sparing surgeries for adenomyosis can be divided into adenomyomectomy for
98 focal adenomyosis and cytoreductive surgery for extensive adenomyosis. For
99 adenomyomectomy, focal adenomyosis or adenomyoma is separated from the normal
100 myometrium and excised. Cytoreductive surgery for extensive adenomyosis requires massive
101 removal of adenomyotic foci including a large amount of healthy myometrium (22).

102 Adenomyomectomy was first introduced by Hyams in 1952 (23). Subsequently, a variety
103 of surgical methods have been introduced to reduce recurrence and complications. Unlike uterine
104 myoma, the plane between adenomyoma and normal myometrium is not well defined. The
105 technique is similar to myomectomy either by laparotomy, laparoscopy (23, 24) or robot assisted
106 laparoscopy (25).

107 For extensive adenomyosis, there are several techniques. Incision on the uterine wall
108 could be vertical, diagonal, H incisions (one vertical and 2 horizontal incisions) or wedge
109 resection of the uterus (27-30). The objective is to obtain access to the adenomyotic mass. The
110 uterine defect is closed in multilayer suturing similar to that in myomectomy, U shaped suturing
111 or overlapping flap technique. In U shaped suturing, the muscularis layers are approximated by

112 U-shape sutures and the seromuscular layer is closed with figure of eight sutures (26). In the
113 overlapping flaps technique, the seromuscular layers are overlapped and sutured to compensate
114 the lost muscle layer of the uterus (24). Another technique is the triple flap method. The uterus is
115 first bisected in the mid-sagittal plane until the uterine cavity is reached. The adenomyotic tissue
116 is removed leaving myometrium 1 cm from the serosa and from the endometrium (27). The
117 endometrium is then closed. On one side of the uterus, the muscularis and serosa are sutured
118 anterior posteriorly. This is followed by bringing the seromuscular layer of the opposite site of
119 the uterus covering the first seromuscular line (28).

120 Most procedures are performed by laparoscopy or laparotomy. A vaginal approach has
121 also been done (29). In order to reduce blood loss, concomitant uterine artery occlusion has been
122 advocated (32,33). Less minimally invasive techniques include laparoscopic electrocoagulation
123 of the adenomyoma (30-32). In women who have completed their family with abnormal uterine
124 bleeding, several intrauterine procedures could be performed (34-44). These include ablation of
125 focal adenomyosis with high frequency ultrasound (HIFU) (33), alcohol instillation into cystic
126 adenomyosis (34), or radiofrequency ablation of focal adenomyosis (35).

127

128 **Results**

129 27 studies were included in the review; 10 prospective and 17 retrospective studies
130 including a total of 1398 patients. 16 studies (890 patients) had complete excision of
131 adenomyosis, 3 studies (68 patients) partial excision, 2 studies (13 patients) excision of
132 adenomyoma, and 9 studies (427 patients) non-excisional technique. Some studies included
133 combined treatments. All studies were observational and adenomyosis was confirmed
134 histopathologically (7-57) (Table 2-4).

135 11 studies evaluated fertility outcome with pregnancy rates varied between studies (25-
136 100%), and live birth rates of 32-100% (Table 5). Complete excision resulted in a higher
137 pregnancy rate of up to 100% vs. 50% in incomplete excision. The best pregnancy rates were
138 found in complete excision of cystic adenomyomas. There were 2 cases of uterine rupture at 37
139 and 32 weeks of gestation in women who had undergone a wedge resection of adenomyomatic
140 uterus (36).

141 Intraoperative blood loss varied widely. It ranges from 30-80ml in laparoscopic
142 adenomyomectomy with or without uterine artery occlusion(7) to 370-400 ml in the double flap
143 and triple flap methods (28, 37). Complications during surgeries included intrauterine adhesion
144 after wedge resection of adenomyosis (36), hematomas that resolved spontaneously (28),
145 intraoperative blood transfusion (38), and cervical tears during hysteroscopy (39) (Table 6).

146 Most studies reported improvement in dysmenorrhea and dyspareunia. After complete
147 excision, 25% to 80% of patients had reduction in menorrhagia, and 50% to 94.7% had pain
148 improvement. After incomplete excision, 40% had improvement in menorrhagia, and 55-94% in
149 pain improvement. In the non-excisional techniques 57%-86.8% of patients had pain control and
150 81.3-98.4% had bleeding control. Unfortunately, a variety of scales of bleeding and pain was
151 used by different authors making it difficult to evaluate the precise improvement with different
152 techniques.

153 Recurrences were found as early as a year after surgery, needing hysterectomy in some
154 cases. Less recurrences were found when medical treatment was started immediately after
155 surgery (Table 7). Recurrence rate is estimated to be 9% in the complete excision technique, 19%
156 in the partial excision and 32.5% in the non-excisional techniques (endometrial ablation and
157 myometrial electrocoagulation).

158

159 **Discussion**

160 Conservative surgical treatment for adenomyosis is effective for symptom-control such as
161 menorrhagia and dysmenorrhea, and most probably for adenomyosis-related infertility. However,
162 treatment should be individualized. For preserving fertility and relieving symptoms, medical
163 treatment is usually the first choice; whereas excisional surgery could be performed for
164 refractory adenomyosis.

165 The results of our review show that over three quarter of women will experience
166 symptom relief after conservative surgery. For women who wish to preserve their fertility,
167 cautions should be taken to minimize removal of normal myometrial tissue. The uterine wall
168 should be reconstructed thoroughly with meticulous suturing without leaving any dead space. In
169 order to allow spontaneous pregnancy, the Fallopian tubes should be left patent. The pregnancy
170 rates after conservative surgical treatment vary widely. However, in a study of 71 women, three
171 quarter of them conceived after surgery with or without adjuvant medical treatment (Table 5,
172 53). The importance of meticulous uterine closure is emphasized by a report of 2 cases of
173 uterine rupture at 37 and 32 weeks gestations (45).

174 There has been no recommendation for a compulsory waiting- time to conceive after
175 surgery for adenomyosis. Yet, some uneventful pregnancies and deliveries had occurred as early
176 as 3 months after surgery. Using our standard after a myomectomy, we recommend a waiting-
177 time of at least 3 months between surgery and trial to conceive. The best symptom improvement
178 is in the first year after surgery. Depending on the duration of follow-up, recurrence rates differ
179 from no recurrence to almost a half of the patients. Adenomyosis recurrence by ultrasound was

180 reported to be 15% in 27 months after surgery (Table 7, 27). As expected the lowest rate of
181 recurrence is after complete excision and highest after non-excisional techniques.

182 The limitations of our study include that most studies in our review were observational
183 retrospective studies with a relatively small number of patients, and some studies had high risk of
184 bias. The definition of complete or incomplete excision was based on the subjective surgeon's
185 perception. Further, no long-term follow-up was available. Comparison between studies were
186 complicated by the heterogeneity in a variety of methods and scales for symptom-assessment.
187 Confounding factors that can affect results including the surgeon's skills and experience were
188 not taken into consideration in studies evaluating fertility after surgery. The term extensive
189 adenomyosis, the type of surgery, and the completeness of excision do not always correlate.

190 In our practice, we treat women with adenomyosis medically. Conservative surgery is
191 offered only to women with focal adenomyoma and we do it similar to that of laparoscopic
192 myomectomy. In order to decrease intra-operative bleeding, the site of uterine incision is
193 infiltrated with dilute solution of vasopressin. Suturing of the uterine defect is performed
194 multilayered with barbed suture (57). Finally, the uterine incision is covered with an adhesion
195 barrier to reduce adhesion formation. The justification of performing extensive surgery beyond
196 that is similar to myomectomy remains unclear.

197 We conclude that conservative surgery for adenomyosis improves pelvic pain, abnormal
198 uterine bleeding and possibly fertility. The best method of surgery is yet to be seen.

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331

332 Fig. 1. A representative section of a uterus with adenomyosis

333 Fig. 2. PRISMA 2009 Flow Diagram

334 Fig. 3.

335 A. Adenomyoma occupying a half of the uterus.

336 B. Incision on the uterine wall followed by dissection of the adenomyotic tissue.

337 C. Suturing of the first flap of the seromuscular layer.

338 D. Serosa of the first flap is removed.

339 E. The second flap is sutured to the first flap.

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342 Table 1. Methodologic quality assessment of the included studies on surgical treatment of adenomyosis.

Authors	Study design	Risk of bias	Comments
Kwon et al. 2015 (40)	Prospective	Low	
Kim et al. 2014 (37)	Retrospective	High	No correction of confounders, mixed postoperative hormonal treatment
Saremi et al. 2014 (36)	Prospective	Low	
Kwon et al. 2013 (41)	Prospective	Low	
Liu et al. 2012 (42)	Prospective	Low	
Dai et al. 2012 (43)	prospective	Low	
Osada et al. 2011(28)	Prospective	Low	
Al Jama et al. 2011 (44)	Retrospective	High	No clear description of evaluation of symptoms
Sun et al. 2011 (26)	Retrospective	High	No clear description of method of diagnosis and outcome validation
Koo et al. 2011 (45)	Retrospective	High	Short time of follow up, additional treatment with GnRHa
Wang et al. 2009 (46)	Prospective	Low	
Wang et al. 2009 (47)	Retrospective	Moderate	Exclusion of patients requiring blood transfusion after surgery
Grimbizis et al 2008 (23)	Retrospective	Moderate	Small cohort number
Takeuchi et al. 2006 (24)	Prospective	High	Time of follow up not indicated, no adequacy of follow up
Wood et al. 1998 (31)	Retrospective	High	No clear description of method of diagnosis, No clear validation of outcome
Fedele et al. 1993 (19)	Retrospective	High	Retrospective diagnosis from histology reports, treatment of concomitant disorders, no controlling for confounding factors, unclear surgical description
Nishida et al. 2010 (38)	Retrospective	Low	
Fujishita et al. 2004 (48)	Retrospective	High	No clear validation of outcome
Preutthipan et al. 2010 (39)	Retrospective	High	No clear validation of outcome
Kang et al. 2009 (49)	Retrospective	Low	
Wang et al. 2002 (50)	Prospective	High	Short follow up period, no clear description of the lesions (focal/diffuse)
Takeuchi et al. 2010 (7)	Retrospective	High	No controlling for confounding factors. 5 patients had endometriosis, not mentioned if excision of the endometrioma was performed.
Wood et al. 1993 (51)	Retrospective	High	No clear validation of outcome
Wood et al. 1994 (52)	Retrospective	High	No clear validation of outcome
Maia et al. 2003 (53)	Retrospective	High	No clear description of the lesions (focal/diffuse), No clear validation of outcome

Philips et al. 1996 (30)	Prospective	High	No clear description of the lesions (focal/diffuse), No clear validation of outcome
Kriplani et al. 2011 (8)	Retrospective	Low	

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345 **Table 2.** Characteristics of studies included in the review of surgical treatment of adenomyosis with complete excision.

Study	Study design	No. patients	Mean age (years)	Population and indication	Technique of adenomyomectomy	Diagnosis
Kwon et al 2015 (40)	Prospective	26	37.7	Diffuse adenomyosis refractory to medical treatment	Laparotomy with occlusion of uterine artery for 9.79 min	TVS
Kim et al. 2014 (37)	Retrospective	9	37	Severe dysmenorrhea and menorrhagia	Laparoscopic assisted: double flap technique	TVS
Saremi et al. 2014 (36)	Prospective	103	37.4	Menorrhagia, repeated pregnancy loss and implantation failures, unexplained infertility	Open- modified adenomyomectomy (wedge-shaped excision)	TVS
Kwon et al. 2013 (41)	Prospective	34	43.8	Refractory to medical treatment	Laparoscopy with occlusion of uterine artery for 7.3±4.1 min	TVS
Liu et al. 2012 (42)	Prospective	186	43.4	Adenomyoma. Patients with extensive uterine adenomyosis were excluded.	Laparoscopy + 6 months of Goserelin treatment postop.	TVS
Dai et al. 2012 (43)	prospective	86		Menorrhagia and dysmenorrhea	Open Adenomyomectomy - Classic technique	TVS
Osada et al. 2011 (28)	Prospective	104	37.6	Adenomyosis involving > 80% anterior or posterior wall, severe dysmenorrhea, menorrhagia or infertility.	Minilaparotomy – Adenomyomectomy - triple flap technique	TVS, MRI
Al Jama et al. 2011 (44)	Retrospective	18	38.1	Menorrhagia, dysmenorrhea and infertility	Open or laparoscopic adenomyomectomy + GnRH α for 24 weeks	TVS, MRI
Sun et al. 2011 (26)	Retrospective	40		Symptomatic focal adenomyosis	Open or laparoscopic adenomyomectomy U-shape suturing	NA
Koo et al. 2011 (45)	Retrospective	18		Menorrhagia and dyspareunia	Open or laparoscopic adenomyomectomy	TVS
Kriplani et al. 2011 (8)	Retrospective	4		Juvenile cystic adenomyoma	Laparoscopy	TVS/ MRI
Takeuchi et al. 2010 (7)	Retrospective	9		Juvenile cystic adenomyoma with dysmenorrhea	Laparoscopy	TVS/ MRI
Wang et al. 2009 (46)	Prospective	165		Dysmenorrhea with or without menorrhagia	Minilaparotomy or laparoscopy (114 with GnRH α postoperatively)	TVS
Wang et al. 2009 (47)	Retrospective	28		Infertility	Laparotomy	TVS
Grimbzis et al 2008 (23)	Retrospective	6	34.8	Repeated pregnancy loss, dysmenorrhea, menorrhagia	Laparoscopy	TVS
Takeuchi et al. 2006 (24)	Prospective	14		Symptomatic focal adenomyosis	Laparoscopy, overlapping flaps	MRI

Wood et al. 1998 (31)	Retrospective	25		Focal/diffuse symptomatic adenomyosis	Laparoscopy	TVS, biopsy
Fedele et al. 1993 (19)	Prospective	28	35.1	Uterine mass proved by histology to be adenomyosis	Laparotomy	Histology

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348 **Table 3.** Characteristics of studies included in the review of surgical treatment of adenomyosis with partial excision and cystic adenomyoma.

Authors	Study design	No. patients	Population and indication	Surgical methods	Diagnosis
<u>Partial excision</u>					
Sun et al. 2011 (26)	Retrospective	13	Focal/diffuse adenomyosis; dysmenorrhea and dyspareunia	Laparoscopy wedge resection	NA
Nishida et al. 2010 (38)	Retrospective	44	Diffuse symptomatic adenomyosis	Laparotomy	MRI
Fujishita et al. 2004 (48)	Retrospective	11	Dysmenorrhea and menorrhagia.	Laparotomy technique incl. H incision	TVS/ MRI
<u>Cystic Adenomyomas</u>					
Kriplani et al. 2011 (8)	Retrospective	4	Juvenile cystic adenomyoma	Laparoscopy	TVS/ MRI
Takeuchi et al. 2010 (7)	Retrospective	9	Juvenile cystic adenomyoma	Laparoscopy	TVS/ MRI

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351 **Table 4.** Characteristics of studies included in the review of surgical treatment of adenomyosis with excision and non-excisional technique

Authors	Study design	No. patients	Population and indication	Surgical technique
Preutthipan et al. 2010 (39)	Retrospective	190	Uterus <12 gestational weeks or uterine length < 12 cm.	Hysteroscopic rollerball endometrial ablation
Kang et al. 2009 (49)	Retrospective	37	Symptomatic adenomyosis. Median age 42 years	Laparoscopic partial resection and uterine artery occlusion
Wang et al. 2002 (50)	Prospective	20	Patients completed their family with dysmenorrhea, menorrhagia or bulk symptoms	Laparoscopic ligation of uterine vessels and electrocoagulation of bilateral uterine ovarian vessels.
Wood et al. 1993 (51)	Prospective	15	Symptomatic adenomyosis	Endometrial resection, laparoscopic excision. hysterectomy
Wood et al. 1994 (52)	Prospective	31	Symptomatic adenomyosis	15- Endometrial resection 7-Lap myometrial reduction 8 – excision of adenomyotic myometrium or localized adenomyoma
Maia et al. 2003 (53)	Retrospective	95	Focal or diffuse	Transcervical endometrial resection +/- Hormonal IUD
Philips et al. 1996 (30)	Prospective	10	Diffuse	Laparoscopic bipolar coagulation
Wood et al. 1998 (31)	Retrospective	18	Focal or diffuse	Endomyometrial resection
Wood et al. 1998 (31)	Retrospective	11	Focal or diffuse	Myometrial electrocoagulation

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355 **Table 5.** Postoperative Fertility Outcomes after surgical treatment of adenomyosis

Authors	Follow up (months)	Desired pregnancy	Pregnancy rate (%)	Live birth rate (%)	Miscarriage rate (%)	Ectopic (%)	Still birth (%)	Complications
Saremi et al. 2014 (36)	24	70 (49 IVF, 21 natural)	21/70 (30%) IVF- 14 Natural- 7	16/21 (76%)	4/21 (19%)	0	1/16 (6%)	2 cases of uterine rupture at 37 & 32w
Osada et al. 2011(28)	24	26	16/26 (61%) IVF- 12 Naturalv- 4	14/16 (87.5%)	2/16 (12.5%)	0	0	None
Al Jama et al. 2011 (44)	36	18	8/18 (44.4%) Natural - 8	6/8 (75%)	2/8 (25%)	0	0	None
Sun et al. 2011 (26)		24	8/24 (33.3%) IVF - 5 Natural - 3	3/8 (37.5%)	5/8 (62.5%)	0	0	None
Wang et al. 2009 (46)	24	-Surgical- 27 -Surgical and medical - 44	-20/27 (74%) All natural -35/44 (79.5%)	17/20 (85%) 32/35 (91%)	3/20 (15%) 3/35 (8.5%)	0 0	0 0	none
Wang et al. 2009 (47)	24	28	13/28 (46.4%) All natural	9/13 (32.1%)	4/13 (14.3%)	0	0	None
Fedele et al. 1993 (19)	52.7 ± 22.2	28	18/28 (64.2%) IVF - 1 Natural -17	9/18 (50%)	7/18 (38.8%)	1/18 (5.5%)	0	None
Fujishita et al. 2004 (48)	36	4	2/4 (50%) All natural	2/2 (100%)				None
Takeuchi et al. 2006 (24)	NA	8	2/8 (25%) All natural	2/2 (100%)	0			
Takeuchi et al. 2010 (7)	35	3	3/3 (100%) All natural	3/3 (100%)				
Nishida et al 2010(38)	12	NA	2 IVF -1 Natural -1			1/2(50%)		

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359 **Table 6.** Surgical approach for adenomyosis

Authors	Operation	Operation time (min)	Diameter preop. (cm)	Diameter postop. (cm)	Estimated blood loss (ml)	Complications	Days of admission
Kwon et al. 2015 (40)	Laparotomy	95	6.85±1.66		191.54	No major complications	5.65
Kim et al. 2014 (37)	Laparoscopy assisted	130.6 ± 20.6	58.3 ± 3.9	23.6 ± 5.9	383.3 ± 192.6	No major complications	7.3 ± 1.1
Saremi et al. 2014 (36)	Laparotomy	86 ± 41.3			365 ± 225	Asherman's syndrome (n:4), Uterine rupture (n: 2)	
Kwon et al. 2013 (41)	Laparoscopy	84.09 ± 31.48			148.18 ± 93.99		3.82 ± 1.24
Dai et al. 2012 (43)	Laparotomy	63.26±21.07			100.35±78.45	No major complications	
Osada et al. 2011 (28)	Minilaparotomy	182.7 ± 62.2			372.0 ± 314.4	Small hematomas resolved spontaneously (n:6)	
Al Jama et al. 2011 (44)	Laparotomy or laparoscopy and GnRHa x 24 wks		10.4 ± 7.3	8.6 ± 4.3			
Koo et al. 2011 (45)	Laparotomy or laparoscopy	92.5			238.9		Scar dehiscence
Wang et al. 2009 (46)	Minilaparotomy or laparoscopy					No major complications	
Wang et al. 2009 (47)	Laparotomy					No major complications	
Grimbzis et al. 2008 (23)	Laparoscopy	100.5			163	0	1
Fujishita et al. 2004 (48)	*Excision Classical technique *Modified H incision	* 121±52 * 177±69			* 224±210 *373±305	Endometrium perforation X2	
Kang et al 2009 (49)	Laparoscopy with uterine artery occlusion	115.7 ± 27.5	224.6 6 48.7 cm3	91.6 ± 28.4 cm3 Shrinkage rate 59%	80.0 ± 35.2	Postoperative fever , morbidity: 10.8%	
Liu et al. 2012 (42)	Minilaparotomy & laparoscopy		2.39±1.16	0.22±0.46			
Takeuchi et al. 2010 (7)	Laparoscopy	78±19.8			33.6±32.1		
Nishida et al. 2010 (38)	Laparotomy	159 ± 43.7			745 ± 56 g	Blood transfusion (n:7)	11

Preutthipan et al. 2011 (39)	Hysteroscopic endometrial ablation	36.3±7.1					
Wang et al. 2002 (50)	Laparoscopic occlusion of uterine and ovarian vessels.	34.2± 10.0	267.9 ± 164.7	217.3 ± 95.0	45.5± 19.3		2.0 ± 0.5
Philips et al. 1996 (30)	Laparoscopic bipolar coagulation	45.1 ± 10.0		68.9% reduction	46 ± 12		3-23 hours

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362 **Table 7.** Adenomyosis symptoms before and after the surgery

Authors	Follow up (months)	Dysmenorrhea pre-op (VAS score 0-10)	Menorrhagia pre-op	Dysmenorrhea post-op (0-10)	Menorrhagia post-op	Comments
Kwon et al. 2015 (40)	7	-	-	Complete remission in 94.4% of patients	Complete remission in 100% of patients	3 recurrences >1 cm
Kim et al. 2014 (37)	12	10	10	4.8 ± 2.5	5.2 ± 2.7 (0-10)	Recurrence (n:3), hysterectomy(n:1)
Saremi et al. 2014 (36)	12	-	-	Decrease in 40% of patients	Decrease in 65% of patients	1 recurrence
Kwon et al. 2013 (41)	6			Complete remission in 72.2% of patients	Complete remission in 87.5% of patients	
Dai et al. 2012 (43)	6	-	-	80% reduction	80% reduction	6 relapses, 2 had hysterectomy.
Osada et al. 2011 (28)	24	10 (VAS) ¹	10	1.67 ± 1.79	2.87 ± 1.77 (0-10)	Recurrence (n:4) in 10 years
Al Jama et al. 2011 (44)	12	-	-	15/18 improved (83.3%)	15/18 improved (83.3%)	No improvement (N:3) and hysterectomized
Sun et al. 2011 (26)	27.6	-	-	Improvement in 91.2% of the patients in complete resection 88.9% in incomplete resection	Improvement in 40% of the patients in complete resection, 50% in incomplete resection	Relapse rate 15% by US
Koo et al. 2011 (45)	9.7	8.1 (NRS) ²	4.3 (MVJ) ³	1.9 (NRS) ²	3.2 (MVJ) ³	
Wang et al. 2009 (46)	24	Surgical 3.8 (VNRS) ⁴ Surgical+GnRHa 3.9	3.08 3.68	1.1 0.7	1.2 0.9	Relapse 49% Relapse 28.1%
Wang et al. 2009 (47)	24	4.9 (VNRS) ⁴		1.8 (VNRS) ⁴		
Grimbizis et al. 2008 (23)	13.7			cured	cured	
Kang et al. 2009 (49)	12	8 (NRS) ²	158 (PBAC) ⁵	4 (NRS) ²	59 (PBAC) ⁵	hysterectomy (n:1) to persistent dysmenorrhea
Takeuchi et al.	NA	10 (VAS) ¹		2.5 (VAS) ¹		

2006 (24)						
Takeuchi et al. 2010 (7)	6	10 (VAS) ¹		2 (VAS) ¹		No recurrence
Kriplani et al. 2011 (8)	12	9.75 (VAS) ¹		0.25 (VAS) ¹		No recurrence
Liu et al. 2012 (42)	12	3.8±0.65 (0-5)	3.45±1.46 (0-5)	0.33±0.57 (0-5)	0.42±0.59 (0-5)	Hysterectomy (n:6). Recurrence: 9% at 36 months
Nishida et al. 2010 (38)	12	9.4 (0-10)		0.8 (0-10)	improvement	Recurrent dysmenorrhea (N: 3) after 1 year
Fujishita et al. 2004 (48)	45.6±15.3 (23-69)			Classic technique: 18% decrease in pain, H incision: 55% decrease in pain		Recurrence (n:4), 1 hysterectomy after 3 years; 1 recurrence in the H incision group
Preutthipan et al. 2011 (39)	12			86.8% of patients had reduced or no pain	98.4% of patients had decreased bleeding	Recurrence (n:3), hysterectomy after 1 year
Wang et al. 2002 (50)	6			75% achieved pain control	81.3% achieved bleeding control	Non-menstrual pain (n:9; 45.0%), hysterectomy (n:3), 45% dissatisfaction
Wood et al. 1993 (51)	24			Improvement: 4/7 endometrial resection; 3/4 myometrial reduction; 3/3 myometrial excision		
Wood et al. 1994 (52)			Endometrial resection 3/8	12/15 Endometrial resection; 7/8 myometrial excision; 4/7 myometrial reduction		
Philips et al. 1996 (30)	12			70% reduction in dysmenorrhea	Resolution	-1 hysterectomy -2 recurrent menorrhagia had resection of the endometrium

363 ¹VAS- Visual analogue scale, ²NRS- numerical rating scale, ³MVJ- Mansfield Voda Jorgersen menstrual bleeding scale, ⁴VNRS- verbal numeric
364 rating scale, ⁵PBAC – pictorial blood loss assessment chart

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