

Increasing trends in Deep Infiltrating Endometriosis (DIE) with Bilateral Endometrioma from Adolescence till Menopause: Case Series

RUBY BHATIA¹, NAAZBIR KAUR², SUNITA MOR³, SHIVANGI JAIN⁴

Abstract

Deep infiltrating endometriosis has varying clinical presentations with certain diagnostic signs and symptoms. Bilateral endometriomas alongwith DIE has been observed in all the age groups in this series at more than 35 years of age.

Keywords: Endometriosis, perimenopause, adnexal mass, DIE

Introduction

Endometriosis is a clinical and a pathological entity characterised by the presence of tissue resembling functional endometrial gland and stroma outside the normal uterine cavity. Endometriosis most commonly affects women in the age group of 24-35 yrs¹. Postmenopausal endometriosis accounts for less than 3% of the cases². The common clinical presentation of endometriosis include chronic pelvic pain, dysmenorrhoea, infertility, dyschezia, dyspareunia and adnexal mass. Diagnosis is usually suspected on the basis of signs and symptoms and confirmed on imaging. Transvaginal ultrasound and MRI (especially in DIE) remains not only a diagnostic modality but also the best guide to decide the management³. Many a times, gravity of symptoms may not correlate with severity of disease and patient may remain asymptomatic even with severest form of disease. Many years may be lost before the definitive diagnosis and final management of endometriosis.

Factors associated with an high risk of endometriosis include family history, nulliparity, early menarche, late menopause, short menstrual cycles, obstruction of menstrual outflow (mullerian anomalies), exposure to diethylstilbestrol in utero, lower body mass index, alcohol use, exposure to severe physical or sexual abuse in childhood and a higher consumption of trans unsaturated fat⁴.

DIE (Deep infiltrating endometriosis) is a severe form of stage 4 endometriosis that extends >5mm under the peritoneal surface. In other words, endometriosis found in a location other than the superficial tissues infiltrating uterosacral ligaments, rectovaginal septum, parametrium, bowel, pelvic wall or urinary bladder constitutes DIE⁵.

In my last 30 years of clinical experience, increasing trends of DIE with bilateral endometriomas has been observed. Here, we describe cases with severe endometriosis and bilateral endometriomas from adolescence till menopause.

Case 1

A-47-year old multiparous postmenopausal woman presented with a 22 week sized mass in the abdomino-pelvic region associated with pain and heaviness in the lower abdomen since many years. There was history of congestive dysmenorrhea since last many years, which was not relieved by NSAIDs. Instead, injectable pain killers were required in every menstrual cycle for relief of pain. Associated history of dyspareunia and dyschezia for last many years was suggestive of endometriosis in this case. On examination, there was an abdomino-pelvic mass, 22 week in size. The mass was soft to firm in consistency, tender with smooth surface and restricted mobility. On per speculum examination cervix was found to be normal and deviated to right

1. Dr. Ruby Bhatia, MD, FICOG, Professor and Unit Chief, MMIMSR, Mullana, Ambala, Haryana
2. Dr. Naazbir Kaur, MS, Senior Resident, MMIMSR, Mullana, Ambala, Haryana
3. Dr. Sunita Mor, MS, Assistant Professor, MMIMSR, Mullana, Ambala, Haryana
4. Dr. Shivangi Jain, Resident, MMIMSR, Mullana, Ambala, Haryana

Address of Correspondence: Dr. Naazbir Kaur, Gill Hospital, Machhiwara, Ludhiana, India, PIN code-141115. Phone No. 7404229909. Email: nbkggill@gmail.com

side. PAP smear was negative for any intraepithelial lesion. On Bimanual pelvic examination- a mass of about 20 week size, soft to firm in consistency with smooth surface was found. Uterus could not be identified separately from the mass. Mobility was restricted and the mass was tender on movement. Movement of the mass was transmitted to the cervix and vice versa. Bilateral fornices were full and tender.

Laboratory investigations were – Haemoglobin; 11.2 gm% , TLC; 6,600/mm³, Blood urea: 16 mg/dl, Serum creatinine: 0.6 mg/dl, Total Bilirubin: 0.3 mg/dl, Urine Microscopy: Normal, Serum TSH: 1.1 µlu/ml. Ca-125: Raised (239.6 U/L), Serum Prolactin: 9.11 ng/dl and Serum FSH: 30 U/L. ESR: 56 mm in the 1st hour, Montoux test: negative , Sputum for Acid Fast Bacilli: negative, Chest X-ray: Normal.

Ultrasound findings showed features of hematometra/pyometra with Bilateral hematosalpinx/pyosalpinx with a uterine size of 17x 6.3cm and ET (Endometrial Thickness) of 4mm. MRI findings were also similar showing an enlarged uterus of 17 x 8 x 6 cm size with organized haemorrhagic endometrial collection of 15 x 6 x7 cm in size extending into upper cervical canal- hematometra. Bilateral adnexa showed complex tubo-ovarian cystic lesions with chronic blood products with right ovary measuring 10 x 3 cm in size and left measuring 7 x 2 cm in size- bilateral endometriomas.

A provisional diagnosis of hematometra with hematosalpinx with bilateral endometrioma was made. Cervical dilation under anaesthesia was done- no blood or pus came out. Fractional curettage showed keratinous and degenerated material along with few inflammatory cells and areas of haemorrhage. Endometrium was negative for Acid Fast Bacilli and CBNAAT, ruling out genital tuberculosis.

An exploratory laparotomy was done after informed consent under general anaesthesia, preceded by ureteric DJ Stenting so to avoid ureteric injury, in view of large hematometra with bilateral endometrioma and hematosalpinx. The peritoneum was tacked to underlying structures with dense adhesions between uterus, adnexa, gut and omentum. Adhesiolysis was done. The uterus was uniformly enlarged upto 20 week size with soft to firm consistency with right Haematosalpinx of 14 x 5 cm size and a left Haematosalpinx of 7 x 5 cms, and bilateral

endometriomas (6x5 cm and 5x2 cm) in size. The pouch of douglas was obliterated by DIE with dense fibrosis and with puckering of the uterosacral ligaments. Subtotal hysterectomy with bilateral Salpingo-oophorectomy was done. All adhesions and endometriotic implants were ablated and excised. The ureters on both sides were found very near to the lateral surface of the cervix. Decision to proceed with a subtotal hysterectomy was taken so as to avoid injury to ureter and a difficult dissection through the puckered uterosacral ligaments to reach below the cervix was made. On cut section, about 1500 cc of hematometra oozed out. Hence, a differential diagnosis of DIE with endometriomas should always be kept in mind even in case of a postmenopausal woman.



Fig.-1: Case 1, Specimen showing an enlarged uterus of 20 weeks size with right hematosalpinx (14x5cms), left hematosalpinx (7x5 cms) and bilateral endometriomas (6x5 and 5x2 cms).

Case 2

A similar case of DIE with bilateral endometriomas has been reported by us in a 45 years old-woman who presented with acute abdominal pain with shock in the emergency department. The ultrasound showed a large 20 x 10 cm cystic mass in left adnexa with uterine size 14cm with multiple fibroids with fluid in peritoneal cavity and cul-de-sac. On exploratory laparotomy, right endometrioma (10x8 cms) with rupture of capsule leading to hemoperitoneum of about three litres was found. Bilateral hematosalpinx was seen alongwith 8x5 cm size endometrioma on the left side. Uterus was 10 week size along with hematometra. Dense adhesions were present between the endometriomas, uterus, gut and omentum. Total abdominal hysterectomy with bilateral salpingo-oophorectomy was done⁶.

Case 3

A-38-years old P₂L₂ with previous two caesarean sections presented with chronic pelvic pain, dyspareunia, dyschezia and polymenorrhagia. Her CA-125 was raised (320 U/L). Ultrasound showed evidence of endometrioma of size 6.7 x 5.9 cms on right side. MRI shows a focal well defined cystic lesion arising from right ovary appearing hyperintense on both T₁ & T₂ weighted sequence, not suppressed on fat saturated images suggestive of haemorrhagic content. The lesion shows fluid fluid levels with T₂ shading effect suggesting endometrioma. Left ovary and uterus were normal. On pelvic examination uterus was retroverted, fixed with tenderness and fullness in right adnexa. Suspecting torsion, an exploratory laparotomy was planned. Dense adhesions with gut, omentum and endometrioma on right side were excised. Excision and ablation of the endometrioma and all the implants was done. There were extensive peritubal and periovarian adhesions also. Post surgery, patient was advised continuous OCPs, but she opted for cyclical OCPs and was lost to follow up. One year later, the patient presented to OPD with chronic pelvic pain. USG showed bilateral endometriomas of size 8x8 and 10x8 cms. Patient was put on continuous OCPs. To our surprise, MRI after one year showed complete regression of endometriomas and endometriotic implants and the patient is still continuing with combined OCPs.



Fig.-2: Case 3, Right ovary shows a well defined cystic mass measuring 6.3 x 5.9 cm containing homogeneously low level internal echoes and fluid-fluid level chocolate cyst. Left ovary measures 5.8 x 4.2 cm. Two well defined cystic masses measuring 4 x 2.7 cm and 2.4 x 2 cm containing internal echoes in them are seen-Corpus luteal cyst.

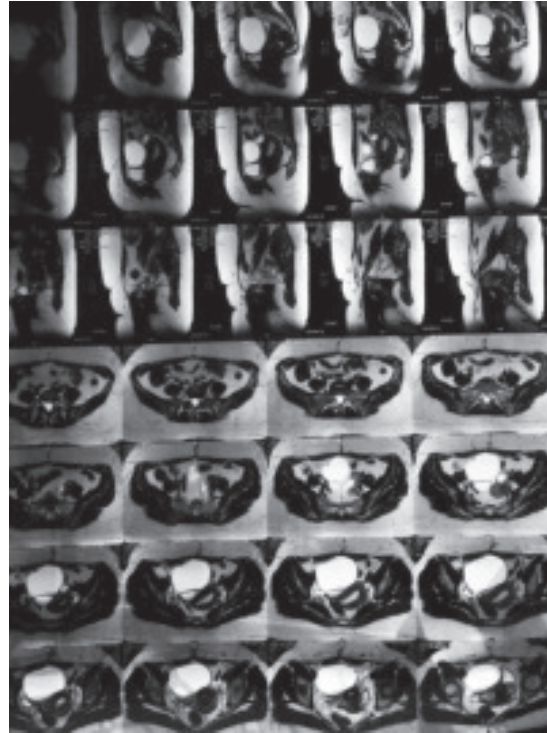


Fig.-3: Case 3, MRI shows a focal well defined cystic lesion arising from right ovary appearing hyperintense on both T₁ & T₂ weighted sequence which is not suppressed on fat saturated images suggestive of haemorrhagic content. The lesion shows fluid fluid levels with T₂ shading effect suggesting endometrioma. Left ovary and uterus- Normal.

Case 4

A-37-years old woman P₂L₂ presented to OPD with complain of pain lower abdomen and dyspareunia since last six months. On examination she had a abdominopelvic mass 16 weeks in size. Per speculum examination showed a healthy cervix and vagina. On bimanual examination, uterus was 16 weeks size. A 6x6 cms mass through right fornix felt, not separate from uterus and a 5x6 cms mass felt through the left fornix. Ultrasonography showed multiple fibroids in the uterus with the largest measuring 5.6x5 cms in posterior wall. Endometrial thickness was 5 mm. Both ovaries showed cystic lesions with internal echoes, measuring 5.7x4.4cms in right ovary and 5.3x5.2 cms in left ovary, suggestive of bilateral endometriomas. A tubular cystic structure with internal echoes seen adjacent to left ovary, suggestive of left hematosalpinx. Her MRI depicted a similar picture of multiple uterine fibroid with bilateral complex tubo-ovarian masses with internal echoes-

endometriomas and left hematosalpinx. On exploratory laparotomy, POD was obliterated with adhesions. Bilateral endometrioma with left hematosalpinx was seen. Total abdominal hysterectomy with bilateral salpingo-oophorectomy was done.

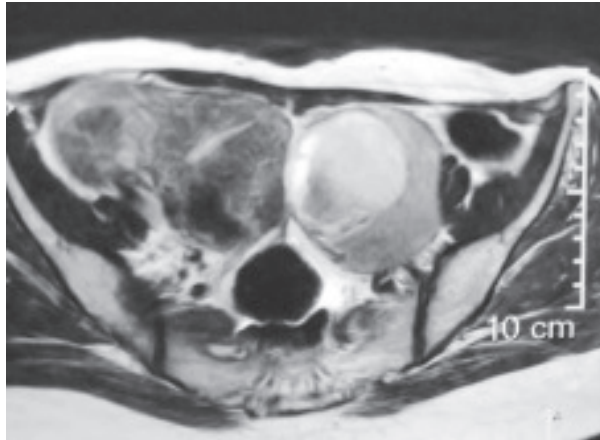


Fig.-4: Case 4, MRI- Uterus is bulky, measures 12 x 6.5 x 5.7 cms. A large subserosal fibroid measuring 5.5 x 4.9cms is seen in fundal region. Multiple smaller intramural and subserosal fibroids are seen in body region in anterior and posterior wall, largest measuring 3 x 2.2 cms in posterior wall. Complex tubo-ovarian cystic lesions are seen in bilateral adnexa measuring approximately 4.8x3.7 cms on right side and 7.2x6 cms on left side. Dilated fallopian tubes are seen at medial aspect of lesions (Left>Right). Multiple thin septations are seen within them. Chronic blood products appearing heterogeneously hyperintense on T_1 and T_2 and FAT SAT with shedding effect on T_2W_1 . Bilateral ovaries are not separately visualized.

Case 5

A-31-years-old-woman with primary infertility for last 10 years presented with heaviness in lower abdomen and menorrhagia. A bimanual pelvic examination confirmed large bilateral adnexal masses. Ultrasound and MRI confirmed nulliparous uterus with 16x10cm right adnexal mass and 15x10 cm left ovarian mass with diffused internal echoes. CA-125 was raised (46 IU/L). Complete workup for infertility and tumour markers were normal except endometriosis. On exploratory laparotomy, DIE with dense adhesions between gut, omentum and uterus were seen. Bilateral large endometriomas in both ovaries with altered tarry chocolate material was seen.

Conservative surgery with resection of bilateral endometriomas and endometrial implants with adhesiolysis was done. Patient was put on injection GnRh agonists (Injection Luprolide 3.75 mg intramuscular) monthly for three months and was advised for IVF-ET⁶.

Case 6

A-31-years-old woman presented with primary infertility for 10 years. She complains of congestive dysmenorrhea, dyspareunia and heaviness in lower abdomen. On bimanual pelvic examination, there was bilateral tender, soft to firm adnexal masses of size 10x7 cms and 10x8 cms in right and left adnexa, respectively. All laboratory investigations were within normal limits except CA-125 which was raised (75 IU/L). CT whole abdomen and pelvis revealed 7.3x4.9 cm lesion with internal echoes in right adnexa and a 4.9x3.5 cm enlarged left ovary with well defined 6.2x2.7 cms tubular structure adjacent to left ovary suggestive of hematosalpinx. Genital tuberculosis was ruled out. Exploratory laparotomy confirmed DIE with bilateral fetal head size endometriomas with large hematosalpinx in left adnexa. Resection of endometriomas with fulgration and ablation of endometriotic implants was done. Post-operative GnRh agonist was given and was advised IVF-ET⁶.

Case 7

An unmarried 19-years-old girl presented in gynaecology out-patient department with 18 week size abdomino-pelvic mass and subacute pain and depression. She was poorly built, undernourished, school drop-out from rural background and lower socio-economic status. Patient was anaemic, hemodynamically stable. CBC, Thyroid profile, X-ray chest, Mantoux test and ESR were normal. CA-125 was marginally raised (60IU/L). However, serum beta-hcg and serum alphafetoprotein were normal. CT abdomen and pelvis depicted 9x7 cm smooth walled, well defined right adnexal mass displacing adjacent gut loops and iliac vessels. Left adnexa showed 7.5x5.3 adnexal mass. A provisional diagnosis of bilateral tubo-ovarian mass was made. Exploratory laparotomy was planned after informed consent. Bilateral 10x10 cms endometriomas replacing both ovaries, filled with altered tarry chocolate material, densely adherent with uterus, gut and omentum was found. Uterus was 10 weeks size with large bilateral hematosalpinx. Dense adhesions in pelvis with bowel and bladder, uterosacral

Table-I
Details of individual cases.

| S.No. | Age | Married/ Unmarried | Clinical Features | CA-125 (U/L) | USG/MRI findings | Intraoperative Findings | Management/ Further advice |
|-------|-----|-----------------------|---|--------------|--|--|--|
| 1. | 47 | Married | Congestive dysmenorrhoea, chronic pelvic pain, adominopelvic mass | 239 | Hematometra with bilateral endometrioma with bilateral hematosalpinx with enlarged uterus. | Dense adhesions between adnexa, uterus, gut and omentum. uterus 20 weeks in size. Bilateral endometrioma (6x5 and 5x2 cms) with bilateral hematosalpinx. | Adhesiolysis with TAH BSO with resection of endometriotic deposit. |
| 2. | 45 | Married | Acute abdomen with shock | - | Cystic mass in left adnexa 20x10 cms. Multiple uterine fibroids with fluid in cul-de-sac | Right endometrioma (10x8 cms) with rupture of capsule. Hemoperitoneum of three litres . Bilateral hematosalpinx alongwith 8x5 cm size endometrioma on left side. Uterus 10 weeks size alongwith hematometra. Dense adhesions between the endometriomas, uterus, gut and omentum. | Adhesiolysis with TAH with BSO |
| 3. | 38 | Married | Chronic pelvic pain, dyspareunia, dyschezia and polymenorrhagia | 320 | Endometrioma -7 x 5.9 cms on right side. Left ovary and uterus normal. After 1 year USG showed bilateral endometriomas of size 8x8 and 10x8 cms. | Dense adhesions with gut, omentum and endometrioma on right side | Excision and ablation of all implants. OCPs Bilateral ovarian Cystectomy |
| 4. | 37 | Married | Pain lower abdomen, dyspareunia, and abdominopelvic mass. | 45 | Multiple fibroids. Bilateral endometrioma (5.7x4.4cms in right and 5.3x5.2 cms in left ovary), with left hematosalpinx. | POD obliterated with adhesions with bilateral endometrioma and left hematosalpinx. | Adhesiolysis with TAH with BSO |
| 5. | 31 | Married | Primary infertility, Heaviness in lower abdomen, menorrhagia | 46 | Nulliparous uterus with 16x10cm right adnexal mass and 15x10 cm left ovarian mass with diffused internal echoes. | DIE with dense adhesions between gut, omentum and uterus. Bilateral large endometriomas. | Conservative surgery with resection of bilateral endometriomas and endometrial implants with adhesiolysis. GnRh agonists and advised IVF |
| 6. | 31 | Married | Primary infertility, congestive dysmenorrhea, dyspareunia and heaviness in lower abdomen. | 125 | 7.3x4.9 cm lesion with internal echoes in right adnexa. A 4.9x3.5 cm enlarged left ovary with well defined 6.2x2.7 cms tubular structure adjacent to left ovary suggestive of hematosalpinx. | DIE with bilateral fetal head size endometriomas with large hematosalpinx in left adnexa. | Resection of endometriomas with fulgration and ablation of endometriotic implants. GnRh agonist and advised IVF. |
| 7. | 19 | Unmarried | Abdomino-pelvic mass, subacute pain and depression. | 60 | 9x7 cm right adnexal mass displacing adjacent gut loops and iliac vessels. Left adnexa showed 7.5x5.3 cm adnexal mass. | Bilateral 10x10 cms endometriomas replacing both ovaries, filled with altered tarry chocolate material, densely adherent with uterus, gut and omentum. Uterus was 10 weeks size with large bilateral hematosalpinx. Dense adhesions in pelvis with bowel and bladder, uterosacral ligaments with fibrous bands and obliteration of pouch of douglas. | Bilateral excision of endometriomas alongwith implants. Continuous combined oral contraceptive pills. Advised IVF after marriage. |
| 8. | 24 | Unmarried | congestive dysmenorrhoea | 62 | Bilateral endometriomas (5.2 x 4.7 cms in left adnexa and a 2.5x1.9 cms in right adnexa with 7x2.5 cms ? right hematosalpinx. | Excision of endometriomas, adhesiolysis with ablation of endometriotic implants. | Continuous combined oral contraceptive pills |

ligaments with fibrous bands and obliteration of pouch of Douglas was seen. Diagnosis of a catastrophic picture of DIE with bilateral endometriomas, hematosalpinx and large uterus was established. Bilateral excision of endometriomas with endometriotic implants was done. Patient was put on continuous combined oral contraceptive pills, three weeks after the surgery. Patient is fine and has been advised for IVF after marriage⁷.

Case 8

A-24-years-old unmarried girl presented with severe congestive dysmenorrhea for last three years. Her pain was not relieved even by injectable painkillers, leading to work absenteeism. Ultrasound and MRI pelvis showed nulliparous uterus with bilateral endometriomas (5.2 x 4.7 cms in left adnexa and a 2.5x1.9 cms cystic lesion with internal echoes in right adnexa). A tubular multiseptate structure 7x2.5 cms was seen adjacent to right ovary. CA-125 was minimally raised (62 IU/L). After complete work up, operative laparoscopy and histopathology confirmed DIE with bilateral large endometriomas and left hematosalpinx. Excision of endometriomas, adhesiolysis with ablation of endometriotic implants was done. Post-operatively patient was on continuous combined oral contraceptive pills⁶.

Discussion:

Endometriosis is a disease of the reproductive age group women, rarely seen before menarche or after menopause⁸. Diagnosis of endometriosis in adolescents and menopausal age group still remains a challenge. About 70% of young adolescent girls with chronic pelvic pain are found to have endometriotic implants on laparoscopy⁹. Nineteen year old young adolescent girl in our study had bilateral endometriomas with DIE while 21 year old unmarried girl had DIE with bilateral endometriosis with hematosalpinx.

Endometriosis is found in 45% - 82% of women with chronic pelvic pain¹⁰. Chronic pelvic pain and dysmenorrhea were presenting complaints in all the cases in our study, with majority of them having palpable abdomino-pelvic mass. CA-125 was marginally raised in all cases in our study. Evidence also suggests slight increase in levels of CA-125¹¹. However, it is not recommended to confirm the diagnosis of endometriosis.

Detailed history taking regarding the patient's menstrual, reproductive and sexual health can reveal

symptoms of endometriosis helping in early diagnosis. Ultrasonography, MRI (method of choice for DIE), IVU (for ureteric involvement), cystoscopy and rectosigmoidoscopy are informative in knowing the extent of disease¹². Presence of T₁ weighted hyperintensity within a dilated fallopian tube is suggestive of endometriosis and may be the only finding at MR imaging in some women¹³, as observed in majority of our cases.

The quality of life can be improved by medical methods like NSAIDs, oral contraceptive pills, progestones (oral, injectable and intrauterine devices), SPRMs (Selective Progesterone Receptor Modulators), Gonadotropin releasing hormone Agonists. Research is also underway for nonhormonal therapy involving VEGF antagonists, immunoconjugates and stem cells¹⁴.

Need of surgery depends upon the size of endometrioma, enhancement of fertility, better pain relief or failure of medical management. Surgery with conservative resection of large endometriomas greater than 5cms and pelvic adhesiolysis followed by long term medical treatment is recommended in adolescents. Operative laparoscopy is superior to laparotomy in management of DIE, however it may depend on surgeon's expertise and experience. Microsurgical techniques with careful and precise dissection should be practised to cause minimal trauma which prevent tissue ischaemia, inflammation and adhesion formation¹⁵. Women with infertility with DIE and endometrioma of more than 5cms should proceed for conservative surgical resection of implants followed by IVF as these women with advanced disease have decreased ovarian reserve, poor oocyte and poor embryo quality with poor implantation¹⁶. Prolonged GnRh agonists given prior to IVF, improves results in cases with stage 4 endometriosis¹⁷. Medical management may be continued after the surgery. After childbearing age total abdominal hysterectomy with bilateral salpingo-oophorectomy remains the treatment of choice.

Conclusion:

Diagnosis of endometriosis should always be kept in mind for all age groups, from adolescence till menopause. Chronic pelvic pain, congestive dysmenorrhea, palpable abdomino-pelvic mass and infertility remains diagnostic presenting symptoms. Also, possibility of an endometrioma in a

perimenopausal patient presenting with an adnexal mass should be kept in mind. Serum CA-125 levels are marginally raised in the majority of cases with stage 3 and 4 DIE endometriosis. Conservative surgical resection followed by long-term medical treatment in adolescents remains the choice of treatment. In DIE associated with infertility, resection of endometriosis followed by GnRh agonists and IVF should be recommended. All perimenopausal women with severe endometriosis, total abdominal hysterectomy with bilateral salpingo-oophorectomy is the standard management.

Conflict of interest: None

References:

- Leibson CL, Good AE, Hass SL, Ransom J, Yawn BP, Ofallon W, et al. Incidence and characterization of diagnosed endometriosis in a geographically defined population. *Fertility and Sterility*. 2004;82(2):314–21.
- Halis G, Mechsner S, Ebert AD. The Diagnosis and Treatment of Deep Infiltrating Endometriosis. *Deutsches Aerzteblatt Online*. 2010;107(25): 446–456.
- LM Giuseppe, Wenger JM, Petignat P, Marci Roberto. Role of imaging in endometriosis. *Cleveland clinic journal of medicine*. 2014;81(6):361-366
- Peterson CM, Johnstone EB, Hammoud AO, Stanford JB, Varner MW, Kennedy A, et al. Risk factors associated with endometriosis: importance of study population for characterizing disease in the ENDO Study. *American Journal of Obstetrics and Gynecology*. 2013;208(6).
- Chapron C. Deep infiltrating endometriosis: relation between severity of dysmenorrhoea and extent of disease. *Human Reproduction*. 2003;18(4):760–6.
- K Parmjit, Bhatia R, Dev A, Kumari S. Bilateral endometriomas with deep infiltrating endometriosis in infertility: An increasing trend. *Asian Journal of Obstetrics and Gynaecology Practice*. 2017;1(4):16-20.
- Kaur P, Bhatia R, Singh KD, Kaur S, Singh AD. Bilateral fetal head size endometriomas with deep infiltrating endometriosis in an adolescent girl. *Med. Res. Chron*. 2015;2(3):425-429.
- Brosens I, Puttemans P, Benagiano G. Endometriosis: a life cycle approach. *American Journal of Obstetrics and Gynecology*. 2013;209(4):307–16.
- Rock JA, Howard W. *Telinde's Operative Gynaecology. Endometriosis*. Lippincott Williams & Wilkins, 2009; 22:438-473.
- Mishra VV, Gaddagi RA, Aggarwal R, Choudhary S, Sharma U, Patel U. Prevalence, Characteristics and Management of Endometriosis Amongst Infertile Women: A One Year Retrospective Study. *J Clin Diagn Res*. 2015; 9(6): QC01–QC03.
- Kitawaki J, Ishihara H, Koshiha H, Kiyomizu M, Teramoto M, Kitaoka Y. Usefulness and limits of CA-125 in diagnosis of endometriosis without associated ovarian endometriomas. *Human Reproduction*. 2005; 20(7):1999–2003.
- Hsu AL, Khachikyan I, Stratton P. Invasive and Noninvasive Methods for the Diagnosis of Endometriosis. *Clinical Obstetrics and Gynecology*. 2010;53(2):413–9.
- EK Outwater, ES Siegelman, P Chiowanich, AM Kelger, CJ Dunton, A Talerma et al. Dilated fallopian tubes: MR imaging characteristics. *Radiology*. 1998;208(2): 463-469.
- Attar R, Attar E. Experimental Treatments of Endometriosis. *Womens Health*. 2015;11(5):653–64.
- Kondo W, Bourdel N, Zomer MT, Slim K. Surgery for deep infiltrating endometriosis: Technique and rationale. *Frontiers in bioscience*. 2013; 5(1): 316-332.
- Sanchez AM, Vanni VS, Vignano P. Is the oocyte quality affected by endometriosis? A review of the literature. *Journal of Ovarian Research*. 2017; 10: 43.
- Surrey ES. Endometriosis related infertility: The Role of the Assisted Reproductive Technologies. *BioMed Research International*. 2015; 5:1-9.