

Role of Interventional Radiology in Obstetrics and Gynaecology: A Retrospective review based on an experience in a Quaternary Care Centre.

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August 2, 2022

Abstract

Objective: The study aims to equip the Obstetrician and Gynaecologist with the knowledge of clinical conditions that will benefit from interventional radiology, the equipment and materials that are commonly used the benefits and the complications and side effects of these techniques. Design :A single centre, retrospective cohort study Population. All obstetric and gynecological cases in which interventional radiology techniques were used Methods: Review article with examples from hospital practice from 2015 to 2021 acquired through computerized database Statistical Analysis: No statistical analysis of data was required as it was a single Centre retrospective analysis of cases. Outcome: We had a total of 35 cases, including but not limited to placenta accreta spectrum disorders ,fibroid,pelvic congestion syndrome and arteriovenous malformation ,who underwent various interventional radiological procedures ranging from embolization of uterine artery, peripheral angiography and embolization ,internal iliac artery balloon placement to ovarian vein embolization and coil insertion . Conclusion: Increased collaborative efforts between interventional radiology and gynaecology would allow for patients to be fully informed on the complete spectrum of surgical and nonsurgical treatment options available to them. Tweetable abstract: Evolving role of interventional radiology in obstetrics and gynaecology

Role of Interventional Radiology in Obstetrics and Gynecology: A Retrospective review based on an experience in a Quaternary Care Centre.

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Abstract

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Design :A single centre, retrospective cohort study

Population. All obstetric and gynecological cases in which interventional radiology techniques were used

Methods: Review article with examples from hospital practice from 2015 to 2021 acquired through computerized database

Statistical Analysis: No statistical analysis of data was required as it was a single Centre retrospective analysis of cases.

Outcome: We had a total of 35 cases, including but not limited to placenta accreta spectrum disorders, fibroid, pelvic congestion syndrome and arteriovenous malformation, who underwent various interventional radiological procedures ranging from embolization of uterine artery, peripheral angiography and embolization, internal iliac artery balloon placement to ovarian vein embolization and coil insertion.

Conclusion: Increased collaborative efforts between interventional radiology and gynaecology would allow for patients to be fully informed on the complete spectrum of surgical and nonsurgical treatment options available to them.

Keywords: Interventional radiology, Obstetrics and Gynaecology, Uterine embolization

Tweetable abstract: Evolving role of interventional radiology in obstetrics and gynaecology

Running title :Interventional radiology in OBGYN

Introduction:

Interventional radiology despite being a relatively new branch of medicine, plays an important role in the management of several disease conditions affecting various organs and systems.

In the field of obstetrics and gynecology, over the past two decades interventional radiology has been instrumental in reducing morbidity and mortality due to obstetric hemorrhages especially in cases with abnormal placental implantations. It has also been used for hemostasis in cases like postpartum hemorrhage, ectopic pregnancies like cervical pregnancy.

Interventional radiology techniques are also being used in the treatment of gynecological conditions like fibroid uterus, adenomyosis and arteriovenous malformations. This is a safer minimally invasive option that obviates the need for surgery and also preserves future fertility.

Objective

This study aims to equip the Obstetrician and Gynaecologist with the knowledge of patient selection and clinical conditions that will benefit from interventional radiology, the equipment and materials that are commonly used, the benefits and the potential complications and side effects of these techniques. We, hereby describe a single centre experience of managing a varied spectrum of obstetric and gynecological conditions aided by different techniques of interventional radiology.

Methods

Study design

This single centre based retrospective study was conducted at Aster Medcity Kochi, a 670 bedded NABH accredited quaternary care centre in Kerala, India, from the period of 2015 to 2021.

All obstetric and gynecological cases in which interventional radiology techniques were used during the period of January 2015 to December 2021 were included. None of the cases were excluded. For all elective cases, a multidisciplinary team meeting consisting of Obstetrician and Gynecologist, Interventional Radiologist and Anesthesiologist was conducted prior to the procedure. Informed consent was taken from every patient prior to the procedure.

The interventional radiology procedures were performed in ‘PHILIPS Hybrid cath lab’ by two interventional radiologists, with one of them having a minimum five years of experience. All patients with arteriovenous malformations (AVM), underwent a contrast CT angiography for assessing the feeding the vessels and draining veins. Patients with Placenta Accreta Spectrum (PAS) disorders were subjected to a non-contrast MRI of abdomen in the late third trimester for maximum possible characterization of abnormal placentation. Nine women of the PAS disorder underwent prophylactic balloon placement in bilateral internal iliac arteries under local anesthesia. Common femoral arteries (CFA) were used as access sites and through 6F sheath, 5mm/6mm of 40 mm length balloons were placed in internal iliac arteries distal to common iliac bifurcation. The sheaths and catheters were anchored to the thigh with sutures and ‘Tegaderm’. Patients were shifted to the operation theatre (OT) for anesthesia and surgery. The interventional radiologists were called to the OT for inflating balloons immediately after the delivery of baby. The balloons were kept inflated to their optimum pressures till the placental extraction/hysterectomy was completed. Then the balloons and sheaths were removed in the theatre and hemostasis achieved by manual compression or using closure devices.

For uterine fibroid embolization (UFE), all patients underwent non-contrast MRI as a baseline imaging for future comparison. Right femoral artery access was chosen for access in all patients; in rare circumstances, left femoral access was also taken. The anterior division of internal iliac arteries was cannulated using 4 or 5F catheters and microcatheter was used for selective access into the uterine artery distal to the branches to cervix. After achieving stable position, the arteries were embolized using PVA particles ranging from 250 to 500micron sizes without causing significant reflux of particles. Good stasis of contrast material in the proximal uterine arteries was taken as the endpoint and confirmed adequate embolization of arteries.

Pelvic AVM cases were rare, and often difficult to differentiate between retained products of conception with significant vascularity in the setting recent pregnancy with occasional coexistence. So, all patients were extensively evaluated and followed up. Recent contrast CT angiogram was taken to identify the feeding arteries, size of the nidus and draining veins. Access was planned based on the CT findings. Arterial route embolization was preferred often, however one of our cases needed both arterial and venous route embolization.

Patients were followed up for 72 hours as in patients for any recurrence of symptoms and complications. Continuous monitoring of vitals (heart rate, blood pressure ,temperature, saturation) was done. Clinical success was defined in terms of recurrence and or need for further surgery. Both obstetric and gynaecology cases were followed up at the time of postsurgical review as per protocol.

Statistical analysis: No statistical analysis of data was required as it was a single centre retrospective analysis of cases.

Results:

We had a total of 35 cases, both obstetrics and gynecological, who underwent various interventional radiological procedures including embolization of uterine artery, peripheral angiography and embolization, internal iliac artery balloon placement and ovarian vein embolization and coil insertion.

Observations have been outlined below in Table-1 and Table-2, for gynaecologic and obstetric cases respectively.

Our case series included nine cases of placenta accreta spectrum (PAS) disorders, four each of fibroid complicating pregnancy and postpartum hemorrhage and the latter underwent obstetric or cesarean hysterectomy for primary or secondary hemorrhage, two with secondary hemorrhage following hysterectomy for gynecological indications, ten cases of Fibroid and six cases of arteriovenous malformations (AVM). The AVM cases included one uterine AVM and five cases of pelvic AVM. One patient of pelvic AVM had rectal ischemia post embolisation and underwent pelvic exenteration surgery. In another case of pelvic congestion syndrome planned for bilateral ovarian vein embolisation, only left side embolisation could be performed due to difficult anatomy.

We now highlight the clinical scenarios in our hospital where interventional radiology and obstetrics and gynaecology collaborated for the management of the patients.

Postpartum hemorrhage :

A 32 year old G3P1L1A1 at 36⁺ weeks gestation with 2 previous LSCS referred with MRI suggestive of Placenta previa with accreta/increta with placenta in the left and inferior wall of uterus, completely covering internal os. There was no evidence of extra uterine extension of placenta, bladder infiltration or bladder tenting/ureteric compression/hydronephrosis.

An elective Caesarean hysterectomy with classical uterine incision with bilateral uterine artery occlusion under general anaesthesia intraoperatively showed placenta completely covering the lower segment, adherent-partially separated. Adnexa were normal. Hysterectomy with placenta insitu was performed. Estimated blood loss was around 500 ml. (Figure1).

A 37 year old referred for postpartum haemorrhage following an emergency LSCS was taken up for laparotomy and exploration with a preoperative emergency uterine artery embolization by interventional radiologist. Intraoperative findings were suggestive of a longitudinal lower posterior uterine wall rupture of 5x1 cm which was repaired. B lynch sutures were applied for atonicity along with other measures to control the haemorrhage. Post operative collapse in ICU led to relaparotomy with total abdominal hysterectomy which showed Couvelaire uterus of 24 weeks size and hemoperitoneum of 1.3-1.5 litres managed by component replacement.

Arteriovenous malformations

A 26 year old known case of idiopathic thrombocytopenic purpura on dapsone therapy with a recent history of medical termination of pregnancy followed by Mirena insertion presented with menorrhagia. Ultrasound study showed no evidence of intrauterine Mirena device and was suggestive of a possible arteriovenous (AV) fistula formation, which was likely acquired. CECT abdomen for further evaluation confirmed an arterial enhancing lesion (1.7 x 1.5 cm) in the myometrium of the anterior uterine body with multiple tiny vascular channels and draining vein suggestive of uterine AV malformation -with a feeder from right uterine artery, however the right uterine artery was not hypertrophied. No abnormal vascular channel was seen from left uterine artery and adnexa was normal. Right uterine artery embolisation was done and findings of tortuous right uterine artery with, prominent and abnormal leash of blood vessels noted. (Figure2). Following embolisation the symptoms resolved.

Pelvic congestion syndrome

A 46 year old parous lady with symptoms of recurrent pelvic inflammatory disease and significant pelvic discomfort, on evaluation with CECT abdomen showed normal uterus with heterogenous myometrium and bilateral mildly dilated and tortuous pelvic veins in parametrium more on the left side, consistent with pelvic vascular congestion or pelvic congestion syndrome (PCS). A unilateral left ovarian vein coil embolisation was done due to difficult anatomy. However, patient improved symptomatically. (Figure 3).

Uterine fibroid

A 31 years old parous lady with severe dysmenorrhea and menorrhagia on evaluation was diagnosed with multiple uterine fibroids. Screening non contrast MRI of uterus showed large sub-mucosal uterine fibroid with

small subserosal fibroids. Uterine Artery Embolisation (UAE) of the fibroid under monitored anaesthesia was done with 250 - 355 CONTOUR PVA Embolisation particles (Boston Scientific) until stasis. There were no immediate complications and procedure was tolerated well. Serial post embolisation MRI after 3 months and 6 months showed serial involution in the size of the fibroids. Remainder of the uterine myometrium showed normal signal intensity with normal cervix. Thus, complete curative result was achieved for uterine fibroids through uterine artery embolization. (Figure 4).

In another scenario of fibroid complicating pregnancy, uterine artery embolization with catheter placement done preoperatively was used as a means to reduce the intraoperative blood loss during the procedure of cesarean myomectomy.

Discussion

Main findings:

Our review of cases in last 5 years included a spectra of obstetric and gynaecological cases encountered routinely and some uncommon ones that benefited due to interventional radiology in terms of avoiding a surgical procedure and also reduced blood loss in the need of a surgical intervention. All nine cases of PAS disorders had a prophylactic balloon catheter placement that were inflated intraoperatively and were instrumental in reducing the blood loss significantly. Almost all patients of AVM who underwent embolisation were symptomatically relieved avoiding a surgical intervention except in one with a complication of rectal ischemia who required an exenteration procedure. Patients with fibroid complicating pregnancy had a prophylactic balloon placement in the event of uncontrolled hemorrhage during cesarean myomectomy which was useful in one case. All cases of fibroid who underwent UFE had symptomatic relief with complete resolution of myoma in all cases.

Interpretation:

1. Transarterial embolization is considered the alternative treatment for PPH, with urgent hysterectomy considered the standard treatment. Hysterectomy guarantees no future fertility, whereas embolization offers the chance of future fertility.
2. Transcatheter embolization of uterine AVM and UFE are minimally invasive alternative options which obviate the need for hysterectomy and related complications and preserve reproductive capability.
3. Proper protocol based selection of cases and multidisciplinary team management helps in reducing failure of procedure and management of complications preventing morbidity.

A literature review of these case scenarios and role of interventional radiology in their management is presented below.

Placenta accreta spectrum (PAS) disorders, comprising placenta accreta, increta, and percreta, are associated with serious maternal morbidity and mortality in both the developed and the developing world and are major contributors to the group of anticipated obstetric hemorrhages.

Placenta accreta complications of placenta accreta include massive haemorrhage, damage to the uterus, bladder, ureters, and bowel.¹

Cesarean hysterectomy is currently the definitive treatment method for PAS disorders^{2,4,5}. Arterial embolisation is highly effective in treating bleeding associated with PASD.^{2,3} The Royal College of Obstetricians and Gynaecologists recommends the early involvement of IR in the management of PPH and use of IR in women at high risk of PPH.³

Brown and Heaston et al^{4,5} first described the use of embolization in the treatment of PPH in 1979. Mathe et al^{4,5} concluded that the severity of hemodynamic instability and need for transfusion associated with PPH was reduced with early angiography and intervention^{4,5}. Review of studies by Eriksson et al. Salomon et al. and Ornan et al.⁴ suggest that overall embolization for PPH appears to have little effect on resumption of menstruation and future fertility as was also seen in our study^{4,5}.

Uterine arteriovenous malformation although a rare entity can represent a life-threatening condition because of severe hemorrhage, requiring blood transfusion in up to 30% of the cases ⁶.

The first case of uterine arteriovenous fistula (AV fistula) has been described back in 1926 by Dubreuil and Loubat⁶. The incidence of acquired AVM (termed as AV fistula) has witnessed a gradual rise in recent years owing to an increase in uterine interventions (those following pregnancy, caesarean section, curettage and abortion).

Traditionally, uterine AVMs have been managed by hysterectomy with or without internal iliac artery ligation. Transcatheter embolization of uterine AVM was first described by Forssman et al in 1982^{4,7}. Since then all studies have reported an overall success rate with transcatheter uterine AVM embolization of over 95% with minimal complications of <4% which include transient paraesthesia /paralysis of the left arm and persistent blue coloration of the cervical os. For those with intractable vaginal bleeding, persistent evidence of AVM, or poor compliance with regular follow-up, surgical intervention should still be undertaken ^{6,7}. Chronic pelvic pain (CPP) accounts for 10–40% of all gynaecological referrals and up to 30% of patients with CPP have pelvic congestion syndrome (PCS) as a sole cause of their pain^{7,10}. The aetiology however is poorly understood and is likely to be multifactorial. ^{7,8,9,10}.

Since its introduction in 1993 by Edward et al ^{9,10} transcatheter embolotherapy (TCE) has transformed the treatment of PCS⁹. Complications of TCE are rare (<4%), and include recurrence of varices, ovarian vein thrombophlebitis, migration of embolic material and irradiation of ovaries^{8,9}. A prospective study comparing ovarian vein embolizations to hysterectomy with oophorectomy (unilateral/bilateral) concluded that ovarian vein embolization was a safe, well tolerated, and effective treatment for chronic pelvic congestion syndrome that did not respond to medical treatment and its therapeutic efficacy compared favourably with traditional surgical treatment. ^{7,8,9,10,15}

Uterine leiomyoma (fibroid) is the commonest benign tumour of the female genital tract affecting 25% of women of reproductive age¹¹. The most common presenting symptom is uterine bleeding although patients may also be referred for pelvic pain, urinary or bowel obstructive symptoms, infertility and miscarriage^{7,11,15}.

The first attempt at percutaneous transcatheter artery embolization for the treatment of uterine fibroids was made by Jean Jacques Merland et al in 1989 and was subsequently published in 1995⁷. Currently embolization has become a first line treatment for symptomatic uterine fibroid tumours in pre-menopausal women and is offered as an alternative to hysterectomy and myomectomy in certain indications^{11,15}.

Fibroids naturally regress after menopause and so the procedure is rarely indicated in post-menopausal women. Because the risk of leiomyosarcoma increases with age, the procedure should not be performed in menopausal women with new onset or worsening symptoms related to presumed leiomyomas⁷. Before contemplating UFE, factors such as current use of gonadotropin releasing hormone (GnRH) agonists that reduce uterine artery calibre, extensive adenomyosis, previous internal iliac artery ligation, the presence of numerous fibroids, and plans for future pregnancy should be borne in mind. Absolute contraindications include pregnancy, malignancy, active genitourinary tract infection, diseased arteries limiting vascular access and high risk of contrast-induced nephropathy. Pedunculated subserosal fibroids are a relative contraindication due to a potential risk of stalk ischemic necrosis and torsion^{7,11,15}.

The REST trial^{7,11} (Randomized Trial of Embolization versus Surgical Treatment for Fibroids) , the embolization versus hysterectomy (EMMY) ^{7,12} trial and HOPEFUL study (a recent multicentre retrospective cohort study) all reported that the embolization patients had a shorter hospital stay, less pain, less adverse effects during hospitalization and a faster return to daily activities and the procedural failures were mainly due to difficult anatomy and absence of a uterine artery ^{7,11,12,13,14}.

Strengths:

The strengths of this study include meticulous data collection with all records derived from a real-time updated electronic database, thereby minimising the possibility of bias. Nonetheless, the present study has several caveats:

Lack of long term follow up data

Prospective, multicentre, larger trials are necessary to consider the safety of UFE in patients desirous of fertility an aspect which wasn't evaluated in our study.

Conclusion

Embolisation therapy particularly uterine artery embolisation can be used as both an alternative to surgical management, and as an adjunct to improve surgical outcomes including reducing intraoperative blood loss. While valuable as an adjunct treatment to reduce intraoperative blood loss, good surgical technique is still required to optimize patient outcome.

Increased collaborative efforts between interventional radiology and gynaecology would allow for patients to be fully informed on the complete spectrum of surgical and nonsurgical treatment options available to them.

Funding: This study was not supported by any funding.

Disclosure of interests: None declared

Ethical approval: The study was performed following the principles of the Declaration of Helsinki. Data were obtained from medical records and de-identified, with no direct participation of patients.

Contribution to authorship:

B.Suguna, S.Arjun, J.Surya: Data collection and management, data analysis, writing and editing the article;

K.Mayadevi, J.Vijay: Conceptualization, protocol development visualisation ,supervision, writing – review and editing the article .

Declaration of Competing interest: The authors declare that they have no conflict of interest.

Acknowledgement: Sherley Mathen, Zareena Khalid, Shamema AS and Teena Joy for their contribution to the case series. Rohit Nair for his valuable inputs on the article.

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No.	Age	Diagnosis	Procedure	Route	EMB agent	Complication	Recurrence
1	42	PHSH	EMB	RCFA	Gel foam	Nil	nil
2	26	Ut AVM	EMB	RCFA	PVA particles	Nil	nil
3	45	FU	EMB	RCFA	PVA particles	Nil	nil
4	41	FU	EMB	RCFA	PVA particles	Nil	nil
5	34	PAVM	EMB	RCFA	Menox-18, Coils, CA(glue)	Rectal ischemia	Nil
6	48	PHSH	EMB	RCFA	PVA particles	Nil	Nil
7	34	PAVM	EMB	RCFA	Coils, CA(glue)	Nil	Nil

No.	Age	Diagnosis	Procedure	Route	EMB agent	Complication	Recurrence
8	34	PAVM	EMB	RCFA	Coils, CA(glue)	Nil	Nil
9	36	FU	UFE	RCFA	PVA particles	Nil	Nil
10	46	PCS	B/L Ov.vein EMB	RCFV	Detachable coils	Difficult anatomy(U/L)	Nil
11	31	FU	UFE	RCFA	PVA particles	Nil	Nil
12	44	FU	UFE	RCFA	PVA particles	Nil	Nil
13	48	FU	UFE	RCFA	PVA particles	Nil	Nil
14	48	FU	UFE	RCFA	PVA particles	Nil	Nil
15	46	FU	UFE	RCFA	PVA particles	Nil	Nil
16	45	FU	UFE	RCFA	PVA particles	Nil	Nil
17	44	FU	UFE	RCFA	PVA particles	Nil	Nil
18	49	FU	UFE	RCFA	PVA particles	Nil	Nil

Table 1: Details of gynaecological indications and the interventional radiology procedure (age in years, PHSH -post hysterectomy secondary hemorrhage, PAVM pelvic AVM, Ut.AVM-Uterine AVM, PCS -pelvic congestion syndrome, FU-fibroid uterus, EMB -embolisation, UFE-uterine fibroid embolisation, Ov.-ovarian vein, RCFA- right common femoral artery ,RCFV-right common femoral vein, PVA-polyvinyl alcohol, CA-cyanoacrylate glue)

No	Age	Diagnosis	Procedure	Route	EMB agent	Complication	Recurrence
1	30	Placenta percreta	PBP B/L IIA	B/LCFA		Nil	Nil
2	32	CH	UAE	RCFA	Particles &coils	Nil	Nil
3	33	Placenta percreta	PBP B/LIIA	B/L CFA		Nil	Nil
4	33	Placenta percreta	PBP B/L IIA	B/L CFA		Nil	Nil
5	29	FC pregnancy(CS)	PBP B/L IIA	B/L CFA		nil	Nil
6	28	Placenta accreta	PBP B/L IIA	B/L CFA		Nil	Nil
7	28	Placenta previa	PBP B/L IIA	B/L CFA		Nil	Nil
8	39	FC pregnancy (CS)	P/A			Nil	Nil

No	Age	Diagnosis	Procedure	Route	EMB agent	Complication	Recurrence
9	32	Placenta increta	PBP B/L IIA	B/LCFA 5F sheaths	Balloons 5mmx4cm & 6mmx4cm	Nil	Nil
10	35	PPH (OH)	EMB	RCFA	PVA particles	Nil	Nil
11	37	CH	UAE	RCFA	Gel foam	Nil	Nil
12	39	Placenta percreta	PBP B/L IIA	B/LCFA		Nil	Nil
13	27	CSM -SH	EMB	RCFA	PVA particles.	Nil	Nil
14	31	Placenta percreta	PBP B/L IIA	B/LCFA		Nil	Nil
15	22	PAVM (EP)	AVM EMB	RCFA, RCFV	Multiple coils &PVA particles.	Nil	Nil
16	30	Placenta accreta	PBP B/L IIA	B/LCFA		Nil	Nil
17	37	Rupture uterus, PPH	Embolisation	RCFA	PVA particles	Post op collapse, OH	-

Table 2: Details of obstetric indications and the interventional radiology procedure (age in years ,CH-cesarean hysterectomy ,FC-fibroid complicating pregnancy PPH-postpartum hemorrhage, OH -obstetric hysterectomy, CSM-SH-cesarean myomectomy with secondary hemorrhage PAVM -pelvic AVM ,EP-ectopic pregnancy ,PBPB/LIIA-prophylactic balloon placement in bilateral internal iliac arteries , EMB -embolisation, CFA -common femoral artery, PVA-polyvinyl alcohol)





