THE ASSOCIATION OF MAHARASHTRA OBSTETRIC & GYNAECOLOGICAL SOCIETIES

AMOGS

MCOG
MAHARASHTRA COLLEGE OF OBSTETRICIANS AND GYNAECOLOGISTS

॥ नार्यस्तु राष्ट्रस्य श्वः ॥
NURTURE, PROTECT & LIBERATE
जागर स्त्रीशक्तीचा, वसा आरोग्याचा !







AMOGS

Practical Manual of Ovulation Induction

Concepts, Clinical Practice and Advances

Editor-in-Chief
Kiran Kurtkoti

Editors
Jatin P Shah
Nilesh Balkawade

Co-Editor
Sharayu Nitin Bhalerao

JAYPEE

JAYPEE BROTHERS

Contents

1. **Physiology of Ovulation** 1
   Nilesh Balkawade, Sharayu Patil
2. **Ovarian Reserve Tests** 13
   Revati Rane, Sharayu Nitin Bhalerao
3. **Oral Ovulogens in Ovulation Induction** 23
   Ashwini Yelikar Kale
4. **Gonadotropins in Ovulation Induction** 28
   Rachana Deshpande (Shah), Padma Rekha Jirge
5. **Choosing the Right Ovulation Induction Agent in Different Scenarios** 35
   Chaitanya Nagori
6. **Adjuvants in Ovulation Induction** 49
   Venugopal M, Kedar Marathe
7. **Ultrasound and Doppler in Ovulation Induction** 58
   Sonal Panchal
8. **Different Protocols for Ovulation Induction in Assisted Reproductive Technology** 73
   Sharayu Nitin Bhalerao, Himani Manish Wankawala
9. **Ovulation Induction in Hypogonadotropic Hypogonadism** 91
   Sheetal Sawankar, Aparna K Raul
10. **Controlled Ovarian Stimulation for Poor Responders** 98
    Jatin P Shah, Nilesh Balkawade, Mahima Lalwani
11. **Controlled Ovarian Stimulation in Expected Hyper-responders for In Vitro Fertilization** 107
    Manjiri Valsangkar, Mugdha Parasnis
12. **Ovulation Induction in Endometriosis** 114
    Asha Rao, Suganya Kathir
13. **Controlled Ovarian Stimulation for Fertility Preservation in Cancer Patients** 125
    Kavya Rao Jalagam, Durga G Rao

JAYPEE BROTHERS

14. Triggers in Stimulated Cycles 134
Samidha Dalvi, Mahima Lalwani

15. Luteal Phase Support in Ovulation Induction Cycle 142
Vaishali Chaudhary, Kadam Kaushal

16. Luteinized Unruptured Follicle 155
Chaitanya Shembekar, Shantanu Shembekar

17. Immediate Complications of Ovulation Induction: Ovarian Hyperstimulation Syndrome and Ovarian Torsion 162
Kundan V Ingale

18. Late Complications of Ovulation Induction 169
B Kalpana, Akila V

19. Pregnancy after Ovulation Induction 174
Kiran Kurtkoti

20. Recent Advances in Ovulation Induction 178
Nandita Palshetkar, Rohan Palshetkar

Index 187

JAYPEE BROTHERS

CHAPTER 19

Pregnancy after Ovulation Induction

Kiran Kurtkoti

INTRODUCTION

Ovulation induction (OI) is a widely used fertility treatment aimed at stimulating the ovaries to produce and release mature oocytes, particularly in women with anovulatory or oligo-ovulatory cycles. This method, often used as a first-line intervention for conditions like polycystic ovary syndrome (PCOS), can be used alone or in conjunction with assisted reproductive technologies (ART). While OI significantly improves the chances of conception, pregnancies achieved through this route often come with increased maternal and fetal risks, especially in women of advanced maternal age (AMA) and those with preexisting metabolic or endocrine conditions.

PREGNANCY FOLLOWING OVULATION INDUCTION AND ASSISTED REPRODUCTIVE TECHNOLOGIES

In many infertile women, OI is the initial approach before advancing to ART such as intrauterine insemination (IUI) or in vitro fertilization (IVF) **(Table 1)**. Success rates for OI alone vary, with live birth rates per cycle ranging from 10 to 25% depending on age, underlying pathology, and medication used.[1] When combined with ART, especially in elderly women or those with diminished ovarian reserve, outcomes improve but carry elevated risks such as ovarian hyperstimulation syndrome (OHSS), multiple gestation, and early pregnancy loss.[2]

TABLE 1: Common ovulation induction agents and features.

Drugs	*Mechanism*	*Indications*	*Advantages*	*Risks/side effects*
Clomiphene citrate	Estrogen receptor antagonist	PCOS and anovulation	Oral and affordable	Thin endometrium and mood swings
Letrozole	Aromatase inhibitor	PCOS and first-line agent	Better endometrial effect	Headache and fatigue
Gonadotropins [follicle-stimulating hormone (FSH)]	Stimulates follicle growth	Failed oral agents	High efficacy	OHSS and multiple pregnancies

(OHSS: ovarian hyperstimulation syndrome; PCOS: polycystic ovary syndrome)

JAYPEE BROTHERS

TABLE 2: Live birth rate per assisted reproductive technologies (ART) cycle by maternal age.

Age (years)	*Live birth rate (%)*
<35	35–40
35–37	30–35
38–39	20–25
40–41	10–15
>42	<10

PREGNANCY IN ELDERLY PATIENTS POST-OVULATION INDUCTION

Advanced maternal age, defined as pregnancy at or above 35 years, is associated with decreased fertility due to diminished ovarian reserve and compromised oocyte quality. Many women of AMA rely on OI with or without ART to achieve pregnancy. Despite technological advances, pregnancy in this population is at higher risk for complications such as miscarriage, gestational diabetes, preeclampsia, and placental abnormalities.[3] Live birth rates after OI in women over 40 drop significantly compared to younger women **(Table 2)**.[4]

MEDICAL COMORBIDITIES IN OVULATION INDUCTION-ASSOCIATED PREGNANCIES

- *Gestational diabetes mellitus (GDM):* Women undergoing OI, particularly those with PCOS or obesity, are at elevated risk for GDM. Elevated insulin resistance from PCOS and hormonal changes associated with OI contribute to this risk.[5] Proper glycemic control is essential to prevent macrosomia, neonatal hypoglycemia, and cesarean delivery **(Table 3)**.
- *Hypertensive disorders of pregnancy (HDP):* Advanced maternal age and multiple pregnancies (common after OI) are independent risk factors for gestational hypertension and preeclampsia. These conditions increase the risk of placental abruption and preterm birth.[6]
- *Obesity:* Obesity reduces the effectiveness of OI drugs, increases the risk of miscarriage, and complicates pregnancy by raising the chances of thromboembolism, cesarean section, and gestational diabetes.[7]
- *Hypothyroidism:* Hypothyroidism affects implantation and fetal neurodevelopment. Subclinical hypothyroidism is common in older women and must be screened and managed during OI and pregnancy.[8]

PSYCHOLOGICAL ISSUES IN ELDERLY PREGNANT WOMEN

Pregnancy achieved after OI in elderly women often brings significant emotional burden. Women may experience heightened anxiety related

JAYPEE BROTHERS

TABLE 3: Complications in pregnancies after ovulation induction.

Complication	*Increased risk factors*	*Prevalence (%)*
Gestational diabetes	PCOS, obesity, and age >35 years	10–15
Hypertensive disorders	AMA, ART, and twin pregnancy	15–20
Miscarriage	Age >35 years and poor oocyte quality	20–40
Preterm delivery	Multiple gestation and uterine issues	10–30

(AMA: advanced maternal age; ART: assisted reproductive technologies; PCOS: polycystic ovary syndrome)

TABLE 4: Risk of Down syndrome by maternal age.

Age (years)	*Risk of trisomy 21*
25	1 in 1,250
30	1 in 1,000
35	1 in 350
40	1 in 100
45	1 in 30

to fetal health, fear of miscarriage, and societal judgment regarding late motherhood. Studies report increased prevalence of antenatal depression and pregnancy-specific anxiety among women conceiving via ART, particularly after prolonged infertility.[9] Counseling and psychosocial support are critical components of care **(Table 4)**.

GENETIC ANOMALY SCREENING IN ADVANCED MATERNAL AGE

Maternal age is a key determinant of chromosomal anomalies. The risk of trisomy 21 increases from 1 in 1,250 at the age of 25 years to 1 in 100 by the age of 40 years.[10] Genetic screening is recommended for all pregnant women of AMA, particularly those who conceived after OI or ART.

Recommended screening modalities include:

- *First-trimester combined screening* [nuchal translucency + pregnancy-associated plasma protein-A (PAPP-A) + free β-human chorionic gonadotropin (hCG)]
- *Noninvasive prenatal testing (NIPT)* using cell-free fetal DNA
- *Chorionic villus sampling (CVS)* or *amniocentesis* for definitive diagnosis.

CONCLUSION

Pregnancy following OI represents a significant medical achievement for women with infertility, but it requires heightened clinical vigilance.

JAYPEE BROTHERS

AMA, metabolic and endocrine disorders, and emotional distress are common challenges. A multidisciplinary approach involving obstetricians, endocrinologists, genetic counselors, and mental health professionals is essential for optimizing outcomes in these high-risk pregnancies.

REFERENCES

1. Palomba S, Santagni S, La Sala GB. Ovulation induction in infertile women with polycystic ovary syndrome: current options and future perspectives. Minerva Ginecol. 2015;67(5):437-48.
2. Fauser BC, Nargund G, Andersen AN, Norman RJ, Tarlatzis B, Boivin J, et al. Mild ovarian stimulation for IVF: 10 years later. Hum Reprod. 2010;25(11): 2678-84.
3. Lean SC, Derricott H, Jones RL, Heazell AE. Advanced maternal age and adverse pregnancy outcomes: A systematic review and meta-analysis. PLoS One. 2017;12(10):e0186287.
4. Deatsman SL, Vasilopoulos T, Rhoton-Vlasak A. Age and fertility: a study on patient awareness. JBRA Assist Reprod. 2016;20(3):99-106.
5. Boomsma CM, Eijkemans MJ, Hughes EG, Visser GH, Fauser BC, Macklon NS. A meta-analysis of pregnancy outcomes in women with polycystic ovary syndrome. Hum Reprod Update. 2006;12(6):673-83.
6. Conde-Agudelo A, Romero R. Single versus multifetal pregnancy: the risk of preeclampsia and other complications. BJOG. 2014;121(8):927-36.
7. Catalano PM, Shankar K. Obesity and pregnancy: mechanisms of short term and long term adverse consequences for mother and child. BMJ. 2017;356:j1.
8. Alexander EK, Pearce EN, Brent GA, Brown RS, Chen H, Dosiou C, et al. 2017 Guidelines of the American Thyroid Association for the diagnosis and management of thyroid disease during pregnancy and the postpartum. Thyroid. 2017;27(3):315-89.
9. Gameiro S, Boivin J, Peronace L, Verhaak CM. Why do patients discontinue fertility treatment? A review of reasons and predictors of discontinuation in fertility treatment. Hum Reprod Update. 2012;18(6):652-69.
10. Loane M, Morris JK, Addor MC, Arriola L, Budd J, Doray B, et al. Twenty-year trends in the prevalence of Down syndrome and other trisomies in Europe: Impact of maternal age and prenatal screening. Eur J Hum Genet. 2013;21(1):27-33.

JAYPEE BROTHERS

AMOGS *Practical Manual of*
Ovulation Induction
Concepts, Clinical Practice and Advances

Salient Features

- This book is special because it reflects not only the science but also the hope and compassion behind fertility care
- Starting with ovulation induction—the very first step in assisted reproduction—it brings together a wide range of drugs and protocols, explained in a simple, practical, yet scientific manner, to aid wise decision-making
- Emphasis is placed on both effectiveness and safety, keeping patient-friendliness central
- Written by renowned experts, the chapters combine experience with clinical utility
- It is designed not only for fertility specialists but also for postgraduates, gynecologists, and clinicians who encounter infertility in their practice
- Above all, this book carries a message of hope—that with knowledge, care, and compassion, we can help couples move closer to their dream of parenthood.

Kiran Kurtkoti MBBS DGO DFP DNB FICOG FMCOG is a distinguished Leader in the field of obstetrics and gynecology, currently serving as the President of the Association of Maharashtra Obstetric and Gynaecological Societies (AMOGS). He is the Director of Shashwat Multi-speciality Hospitals India Pvt Ltd, Pune, Maharashtra, India, and the Founder President of both the Maharashtra College of Obstetricians and Gynaecologists and the AMOGS Teachers Forum, organizations dedicated to advancing education and practice in women's health. He has been recognized for his outstanding contributions with prestigious awards, including the Dr Siuli Rudra Sinha Prize and the Dr CS Dawn Prize. He is also an accomplished author, having contributed numerous chapters to books on critical topics such as recurrent pregnancy loss (RPL) and medical termination of pregnancy (MTP).

Jatin P Shah MBBS MD DGO is the Director, Mumbai Fertility Center, Kamala Polyclinic and Nursing Home, Mumbai, Maharashtra, India. A pioneer in assisted reproductive technology (ART) in India, he has been at the forefront of IVF and ICSI since the early 1990s. Renowned both nationally and internationally, he has facilitated over 20,000 successful IVF pregnancies. A recipient of several academic gold medals and the "Young Personality of the Year" award by the Governor of Maharashtra (2003), he is also a Founder Member of ASPIRE (Asia Pacific Initiative on Reproductive Endocrinology). He has contributed to more than 500 national and international conferences as faculty and has published widely on challenging areas of IVF, including repeated implantation failure, thin endometrium, and progesterone elevation in IVF outcomes. His clinical expertise and research contributions continue to influence IVF practice in India and globally.

Nilesh Balkawade MBBS MS DNB (Obs & Gyne) MNAMS FIAGE Fellowship in Reproductive Medicine Diploma in Gynecology Endoscopy (Kiel, Germany) is the Regional Medical Head at Oasis Fertility, Pune, Maharashtra, India. He serves as the 2nd Joint Secretary of AMOGS, General Secretary of POGS, and Treasurer of the Maharashtra Chapter of ISAR. Additionally, he is the Convenor of the AMOGS MCOG ABCDI Program, playing a key role in advancing medical education and training. He has been recognized for his exemplary contributions with the Dr Smita Jog Award for Best Debutant Managing Committee Member of POGS. He is also the recipient of the prestigious AMOGS We for Stree Award, presented by the Governor of Maharashtra.

Sharayu Nitin Bhalerao MBBS MS (Obs & Gyne) DNB MRCOG Fellowship in Infertility and Endoscopy is Senior IVF Consultant, Oasis Fertility, Pune, Maharashtra, India. She is a highly accomplished IVF specialist with over 15 years of experience in assisted reproductive technology (ART). A topper throughout her academic career, she is a distinguished member of the Royal College of Obstetricians and Gynaecologists (UK). She has been honored with the Dr Vikhe Patil Foundation Appreciation Award for her significant contributions to health care in rural communities. In her current position, she continues to provide expert care and treatment to couples struggling with infertility.

Buy from ejaypee

JAYPEE BROTHERS

Shelving Recommendations
OBSTETRICS & GYNECOLOGY

ISBN 978-93-7202-707-5