

diginerve
A Jaypee Initiative

Your Guide at Every Step
Video Lectures | Notes | Self-Assessment



Scan to
download
the App

AMOGS Handbook on Practical Aspects of Infertility

Editors

Nandita Palshetkar
Chaitanya Shembekar

Co-Editors

Nilesh Balkawade
Rohan Palshetkar
Parul Saoji

Forewords

Hrishikesh Pai
Rajendra Singh Pardeshi



Contents

1. Evaluation of Infertile Couple 1

Sachin Kulkarni, Meghashree Deshmukh

- Physical Examination of Infertile Female 2
- Diagnostic Investigations 2
- History Taking 3
- Primary Investigations 4
- Secondary Investigations 4
- Evaluation of Ovaries 4
- Evaluation of Fallopian Tubes 6
- Evaluation of Uterus 7
- Evaluation of Male Infertility 8
- Evaluation of Retrograde Ejaculation 12

2. Evaluation of Male Partner 15

Gayatri Wadekar, Soumya Ramesh

- Evaluation of the Male Partner 16

3. Semen Analysis and Beyond Role of Sperm Function Tests 20

Gouri Sultane Gupta, Firuza R Parikh

- Semen Analysis 20
- Antisperm Antibodies 21
- Hormonal Evaluation 21
- Sperm DNA Fragmentation Index 22
- Sperm Fluorescent In Situ Hybridization 22
- Genetic Testing 23

4. Ovarian Reserve Tests 26

Swati Sarda, Kanchan Ghuse Kelwade

- Age 26
- Menstrual Cycle Pattern 27
- Ovarian Volume 29
- Ovarian Doppler 29
- Ovarian Biopsy 29
- Key Notes (The American Society for Reproductive Medicine Committee Opinion, 2020) 30

5. Ultrasound in Infertility 33*Ritu Hinduja, Vaishali Mundhe Akarte*

- Male Infertility—Workup 34

6. Hysterolaparoscopy in Infertility 45*Parul Saoji, Chaitanya Shembekar*

- Polycystic Ovary Syndrome 45
- Ectopic Pregnancy 46
- Endometriosis 46
- Pelvic Adhesions 47
- Ovarian Cysts 47
- Tubal Block 48
- Fibroids 48
- Low Ovarian Reserve 49
- Hysteroscopy in Infertility 49
- Tubal Cornual Occlusion 50

7. Evaluation and Management of Tubal Factors 55*Anjali Bhirud, Sarika Zunjare, Ashish Zarariya*

- Causes for Tubal Infertility 55
- Hull and Rutherford 2002 Classification of Tubal Damage 56
- Tubal Assessment Tests 56
- The Royal College of Obstetricians and Gynaecologists Guidelines for Tubal Evaluation 59
- Tuberculosis and Tubal Factor Infertility 60
- Management of Tubal Factor Infertility 60

8. Evaluation and Management of Uterine Factors in Infertility 63*Amrita Tandon, Sudha Tandon*

- Evaluation and Management of Congenital Uterine Factors 63
- Septate Uterus 65
- Unicornuate Uterus 67
- Bicornuate Uterus 67
- Uterine Didelphys 68
- Management of Other Complex Müllerian Anomalies 68
- Acquired Uterine Pathologies 68

9. Evaluation of the Male Infertility Factors 74*Rishma Dhillon Pai, Balasaheb Khadbade*

- Interpretation of Semen Analysis: Macroscopic Parameters 76
- Interpretation of Semen Analysis: Microscopic Parameters 78
- Male Hypogonadism 81
- Azoospermia: Evaluation 83
- Anejaculation 86

10. Evaluation and Management of Azoospermia 90

Sheetal Sawankar, Satish Patki

- Definition 90
- Evaluation of an Azoospermic Male 91
- Management of Cases of Azoospermia 94

11. Step by Step Management of Infertility in Polycystic Ovary Syndrome 99

Girish Godbole, Manjiri Valsangkar

- Management of PCOS—OI in PCOS-Fertil-Steril 2008 100
- Strategies to Improve Pregnancy Rates in IVF in PCOS 104

12. Thyroid Disorders and Hyperprolactinemia in Infertility 106

Milind R Shah, Jhelam Deshmukh

- Thyroid Disorders and Female Infertility 106
- Hyperprolactinemia 111

13. Endometriosis and Infertility 117

Ashish Kale, Ashwini Yelikar Kale

- Proposed Biological Mechanisms to Explain Infertility in Endometriosis 117
- Impaired Endocrine Function, Folliculogenesis and Ovulatory Functions in Endometriosis 118
- Endometriosis Fertility Index 124

14. Fibroids and Fertility 127

Chaitanya Shembekar, Parul Saoji

- Fibroids—Evaluation and Classification 127
- Recommendations 128
- Classification of ESGE/FIGO PALM-COEIN 128
- Mechanisms of Infertility 129
- Does the Presence of Uterine Fibroids Reduce Implantation Rates? 131
- What About the Fibroids that do not Cause Distortion of a Cavity? 131
- To Remove or not to Remove? That is the Question 131
- What is the Pragmatic Approach to Management? 132
- Does the Medical Treatment have any Role in the Management of Fibroids with Infertility? 134
- Surgical Treatment 134

15. Infections in Infertility 140

Jyotsana Daule, Anil Bendre

- Infections Causing Infertility in Male and Female 140
- Investigations 143
- Treatment 145
- Male Infertility 147

16. Unexplained Infertility	149
<i>Chaitanya Shembekar, Parul Saoji</i>	
• Laparoscopic Surgery in Unexplained Infertility	150
17. Step by Step Management of Infertility	155
<i>Aditi Tandon, Sadhana Desai</i>	
• Epidemiology of Infertility	155
• Evaluation and Workup for Infertile Couples	156
• Sperm Chromosome Aneuploidy	168
• Unexplained Infertility	168
18. Intrauterine Insemination: Indications and Protocol	174
<i>Unnati Mamtara, Parzan Mistry</i>	
• Indications of Intrauterine Insemination	174
• Factors Influencing IUI Success Rates	174
• Prerequisite for Intrauterine Insemination	174
• Protocol for Intrauterine Insemination	175
• Timing of Intrauterine Insemination	176
• Role of Double Intrauterine Insemination	177
• Gonadotropins and Intrauterine Insemination	177
• Adjuvants in Ovulation Induction	179
19. Ovulation Induction	181
<i>Parag Hitnalikar, Anil Chittake, Rahul Patil</i>	
• Hyperprolactinemia	181
20. Adjuvants in Polycystic Ovarian Syndrome	190
<i>Rajeev Dabade, Meenal Chidgupkar</i>	
• Rationale for Use of Adjuvants	190
• Adjuvants	192
21. Adjuvants in Diminished Ovarian Reserve	198
<i>Shilpi Sood, Chaitanya Shembekar, Laxmi Shrikhande</i>	
• Management of Diminished Ovarian Reserve	199
• Role of Adjuvants in Diminished Ovarian Reserve	199
• Managing Diminished Ovarian Reserve Patients Based on the POSEIDON Criteria	205
22. Diagnosis of Diminished Ovarian Reserve	208
<i>Ameet Patki, Garima Sharma</i>	
• Diagnosis	208
• The Bologna Criteria	208
• Limitations of the Existing POR Criteria	209
• POSEIDON (Patient-oriented Strategies Encompassing Individualized Oocyte Number) Classification	210
23. Pre-In Vitro Fertilization Evaluation	213
<i>Sangeeta Tajpuriya, Umesh Sawarkar</i>	
• General Evaluation	213
• Reproductive System Evaluation	214

24. Ovarian Stimulation in Normal Responders217

Sanjeev Madhav Khurd, Aditya Khurd, Sadhana Khurd

- Desired and Optimum Response to Ovarian Stimulation 217
- Factors Affecting Ovarian Response 218
- Drugs for Ovarian Stimulation 219
- Superovulation for Intrauterine Insemination Cycle 220
- Controlled Ovarian Stimulation for IVF/ICSI with GnRH Antagonist Protocol 221
- Controlled Ovarian Stimulation for IVF/ICSI with Long GnRH Agonist Protocol 222

25. Preinduction Adjuvants.....224

Paresh Gandecha, Shalaka Mamidwar

- Metformin 224
- Myoinositol 225
- Dehydroepiandrosterone 226
- Testosterone 226
- Growth Hormones 227
- Antioxidants 227
- Folic Acid 228
- Aspirin 228
- Low-Molecular-Weight Heparin 228
- Corticosteroids 229
- Estrogen 229

26. Various Ovarian Stimulation Protocols and their Clinical Significance231

Sanjay Gupte, Sachin Jadhav

- Ovarian Stimulation Protocols 232
- Pre-In Vitro Fertilization Priming 234
- Which Gonadotropin? 235
- Decision Making on Type of Protocol to Use 236
- Newer Protocols 236
- Our Experience and Clinical Evidence 238

27. Complications of Ovarian Stimulation241

Kedar N Ganla, Priyanka Harshavardhan Vora, Rana Choudhary

- Ovarian Hyperstimulation Syndrome 241
- Multiple Gestation 242
- Ectopic (Tubal) Pregnancies 245
- Adnexal Torsion (Ovarian Twisting) 246
- Cancer 247
- Limited or Overall Body Reactions 248

28. Controlled Ovarian Hyperstimulation and Management of Polycystic Ovaries in In Vitro Fertilization.....249

Nagadeepti Naik, Duru Shah

- Pathogenesis 249
- Indications 252
- Cryopreservation of Embryos (Freeze-All Strategy) 253
- Complications 253

29. Management in Diminished Ovarian Reserve and Controlled Ovarian Hyperstimulation	257
<i>Jatin Shah, Amiti Agrawal</i>	
• Newer Advances	260
30. Trigger in In Vitro Fertilization	262
<i>Sonali Tawde, Revati Rane, Milind Patil</i>	
• Physiology of Trigger	262
• Prerequisites of Trigger	268
• Choice of Trigger	269
• Empty Follicle Syndrome	270
31. Luteal Phase Support.....	272
<i>Nisha Nikheel Pansare, Chaitanya Shembekar</i>	
• Luteal Phase Defect Mechanism	272
• Duration of Luteal Phase Support	272
• Drugs Used in Luteal Phase Support	273
• Luteal Phase Support in Intrauterine Insemination and Ovulation Induction Cycle	276
32. Managing Quality Control and Quality Management of IVF Laboratory	279
<i>Kalyan Baramade, Manisha Barmade</i>	
• What are the Standard Quality Indicators?	280
• Quality Management in ART Laboratory	282
• Sterility and Infection Control in the Sterile Zone	285
• Maintenance of Essential Pieces of Equipment and Checkpoints in an IVF Laboratory	286
• Disposables and Consumables	286
• Monitoring of Laboratory Environment	288
• Record Keeping and Documentation	289
• Laboratory Staffing	290
• Occupational Training	290
• Code of Practice	291
33. Ovarian Hyperstimulation Syndrome	293
<i>Bansi Shinde, Shashikant Umbardand</i>	
• Incidence	293
• Pathophysiology	293
• Clinical Diagnosis	294
• Classification	294
• Prevention	296
• Prognosis	298
• Management	299
34. Recurrent Implantation Failure.....	304
<i>Mohan Raut, Mugdha Raut</i>	
• Incidence	304
• Definitions	304

- Causes 305
- Investigations 305
- Treatment 310
- Prognosis 313
- Guidelines 314

35. Thin Endometrium316

Nandita Palshetkar, Rohan Palshetkar

- Causes 316
- Diagnosis 318
- Management 319
- Platelet-rich Plasma 321
- Endometrial Scratching 322
- Stem Cell Therapy 322

36. Recurrent Pregnancy Loss325

Sushma Deshmukh, Ashutosh Thole, Shashikant Raghuwanshi

- Spectrum and Definition 325
- Etiology 325
- Endocrine Etiologies 333
- Idiopathic Factors 334
- Complete Evaluation and Counseling 334

37. Application of Stem Cells in Infertility.....337

Sunita Tandulwadkar, Nilesh Balkawade

- Introduction: What are Stem Cells? 337
- Characteristics of Mesenchymal Stem Cell 337
- Stem Cell Harvest and Infusion 337
- Azoospermia 339
- Refractory Endometrium 339
- Premature Ovarian Failure 340
- Regulation of Research in India 342
- Ethical Concerns 342

38. Algorithms for Artificial Intelligence in Reproductive Medicine.....345

Leena Patankar, Amit Patankar

- Role of Artificial Intelligence in Reproductive Medicine 345
- Workflow of Artificial Intelligence in Reproductive Medicine 346

39. Sperm Selection Technique355

Shilpa Bhendarkar Joshi, Indrajeet Mulik, Sandip Nikhade, Rajvi Mehta

- Need of Sperm Preparation 355
- Sperm Preparation Techniques 355
- Microfluidics for Sperm Sorting (Future Prospects) 362

40. Selecting Best Embryo for Transfer.....364

Vijay Mangoli, Neelam Bhise

- Criteria for Embryo Selection based on Morphology 364

41. What is New in In Vitro Fertilization?.....375*Bindu Chimote, Kalpana Jetha, Shravani Welekar, Rooprekha Waghmare*

- Laboratory Culture Conditions (Culture Media) 375
- Newer Culture Media Options 376
- New Advances in Fertilization Techniques 376
- Time-lapse Technology 377
- Assisted Embryo Hatching 378
- Safety Concerns Associated with Laser Application 378
- Preimplantation Genetic Testing 379

42. Anesthesia for Laparoscopy381*Manisha Shembekar, Hemangi Abhyankar*

- Physiological Effects of Pneumoperitoneum 382
- Physiological Effects of Positioning 382
- Management of Anesthesia 382

43. Anesthesia for Oocyte Retrieval.....386*Manisha Shembekar*

- Types of Anesthesia 386

44. Anesthetic Considerations for Operative Hysteroscopy389*Manisha Shembekar*

- Anesthesia for Hysteroscopic Procedures 390
- Tips and Tricks to Reduce Fluid Absorption 392

***Index* 395**

INTRODUCTION

Ovarian reserve is defined as the number of oocytes (oocyte quantity) remaining in the ovary. Ovarian reserve tests (ORTs) are hormone levels and sonographically measured features of ovary. ORTs help to predict the ovarian response to stimulation and not pregnancy. Ovarian response is defined as the actual oocyte yield after ovarian stimulation.

Diminishing ovarian reserve is a phenomenon noted in women during mid to late 30s and at times earlier, reflecting the declining follicular pool and oocyte quality.¹

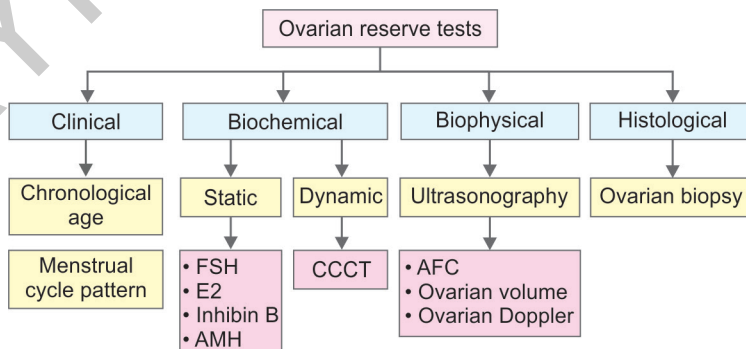
An ideal ORT should be easy to perform, reproducible, and easy to interpret for decision making regarding further treatment of the subfertile woman.

Available ORTs are divided into biological, biochemical, biophysical, and histological tests and have been shown in **Flowchart 1**.

AGE

Ovarian reserve correlates inversely with age, but there is considerable variation in ovarian reserve among women of the same chronologic age.²

Flowchart 1: Ovarian reserve tests.



(AFC: antral follicle count; AMH: anti-Müllerian hormone; CCCT: clomiphene citrate challenge test; FSH: follicle-stimulating hormone)

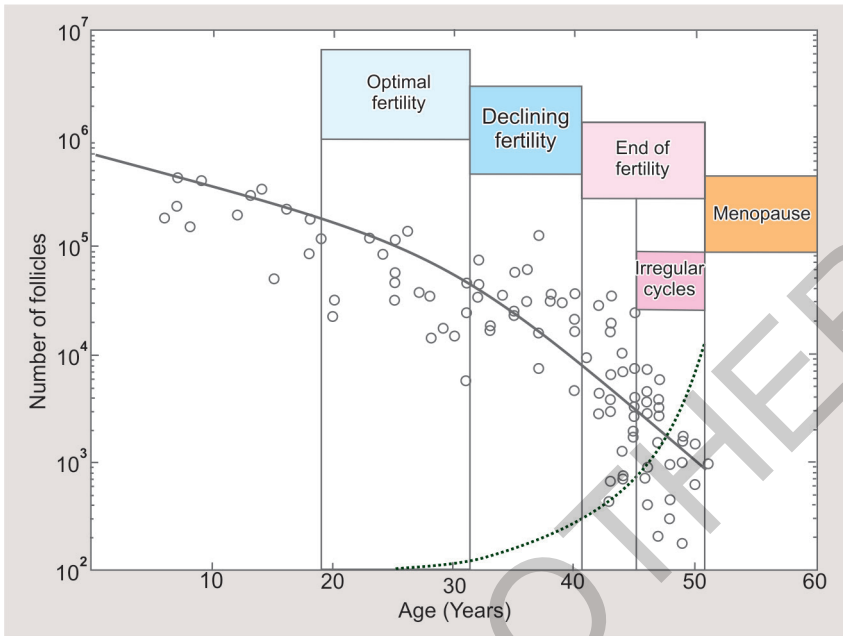


Fig. 1: Quantitative (solid line) and qualitative (dotted line) decline of the ovarian follicle pool, which is assumed to dictate the onset of the important reproductive events.¹⁰

Fecundity in both natural and stimulated ovarian cycles declines with maternal age, beginning in the late 20s and becoming more abrupt in the late 30s (**Fig. 1**).

Age is known to be the most important factor determining the pregnancy potential in regularly cycling women.³⁻⁵ However, chronological age alone has a limited value in predicting individual ovarian responses.⁶⁻⁹

MENSTRUAL CYCLE PATTERN

Women with normal ovarian reserve have regular predictable menstrual pattern. Women with diminished ovarian reserve (DOR) show altered menstrual pattern with short cycles and reduced menstrual flow.

In DOR, the earlier increase in follicle-stimulating hormone (FSH) levels stimulates an earlier onset of new follicular growth and an increase in estradiol (E2) concentrations, ultimately decreasing the length of the follicular phase and the overall cycle.

Follicle-stimulating Hormone and E2

Basal serum FSH levels are elevated on days 2–4 of the menstrual cycle in women with DOR. Elevated FSH is a specific, but not sensitive, test for DOR.¹¹ There is no universally accepted cut-off with a wide range in threshold value up to 25 IU/L is used to identify poor response.

However, FSH levels have significant inter- and intracycle variability that limits the reliability of a single measurement, high intercycle variability suggests more advanced DOR.^{12,13}

Basal E2 alone is not a reliable predictor of DOR. It has a role in correct interpretation of normal FSH. An early rise in serum E2 concentrations is a classic characteristic of reproductive aging and can lower an otherwise elevated basal FSH level into the normal range. When the basal FSH concentration is normal but the E2 level is elevated (>60–80 pg/mL), this may indicate DOR.¹⁴

Anti-Müllerian Hormone

Anti-Müllerian hormone (AMH) is a dimeric glycoprotein, produced by granulosa cells of preantral and small antral follicles which are gonadotropin independent. Therefore, AMH levels remain relatively consistent within and between menstrual cycles in both normal and subfertile women.^{15–18}

Anti-Müllerian hormone levels strongly correlate with basal antral follicle count (AFC) measured by transvaginal ultrasonography.¹⁹

Various threshold values, 0.2–1.26 ng/mL, have been used to identify poor responders with 80–87% sensitivity and 64–93% specificity.^{20–22} AMH is known to have the ability to predict a hyper-response as well.^{19,23}

It is considered that at levels 0.5–1.26 ng/mL, AMH indicates perimenopausal transition within 3–5 years.²⁴ Levels within this range still suggest favorable results with assisted reproductive technology (ART).

Anti-Müllerian hormone levels may be decreased in women currently using hormonal contraceptives and, therefore, should be interpreted with caution in those patients.²⁵

Anti-Müllerian hormone is a more sensitive marker of ovarian reserve than FSH and tends to decline before FSH rises.²⁶ For this reason, AMH has largely replaced basal FSH and E2 level testing as a biomarker of ovarian reserve.

Anti-Müllerian hormone has a unique place among ORTs as it may be applicable as a screening test in a general subfertile population.²⁴

Inhibin B

Inhibin B is a glycoprotein hormone produced by preantral follicles and therefore indicates the follicular pool. As the number of ovarian follicles declines with age, early-follicular-phase inhibin B concentrations decline.

Reduced inhibin B levels lower the level of central negative feedback, causing late-luteal and early-follicular rise in FSH concentrations.

Inhibin B alone is not a reliable predictor of ovarian reserve.^{27,28}

Clomiphene Citrate Challenge Test

Clomiphene citrate challenge test (CCCT) is a dynamic test for ovarian reserve involving the administration of 100 mg of clomiphene citrate from the

5th day of the cycle for 5 days. Basal FSH on day 3 of the cycle and stimulated FSH on day 10 is measured.

However, a meta-analysis has shown that CCCT is no better than non-dynamic tests in predicting DOR or pregnancy and should be abandoned.¹¹

Antral Follicle Count

Antral follicle count is the sum of number of antral follicles (2–10 mm) in both ovaries measured by transvaginal ultrasonography in the early follicular phase. A count of 8–10 is considered as a predictor of a normal response. It is found that the number of AFs 2–6 mm in size declines with age, correlates with other markers, and appears to be more reliable marker of ovarian reserve.²⁹

Antral follicle count is considered to have the best discriminating potential for a poor ovarian response compared to the total ovarian volume and basal serum levels of FSH, E2, and inhibin B on day 3 of the cycle but lacks the sensitivity and specificity to predict the nonoccurrence of pregnancy.^{30,31} AFC has low intercycle variability and high interobserver reliability in experienced centers.^{32,33}

More than 14 AFs are considered to be a good predictor of hyper-response.³⁴ Three-dimensional (3D) ultrasound does not have any advantage over two-dimensional (2D) ultrasound in the assessment of ovarian reserve.³⁵

OVARIAN VOLUME

The ovarian volume is measured by transvaginal ultrasonography applying the formula for an ellipsoid ($D1 \times D2 \times D3 \times \pi/6$).

The ovarian volume remains unchanged till the perimenopausal period and does not add to the predictive value of AFC.^{31,34}

OVARIAN DOPPLER

The observation of the ovarian Doppler flow during ovarian stimulation has been studied in in vitro fertilization (IVF) cycles. The increase in the Doppler flow noted during stimulation is considered not to provide additional information to AFC.³⁶

OVARIAN BIOPSY

Ovarian biopsy done at laparoscopy or laparotomy has shown that the follicular density reduces with age.³⁷ Also, women with unexplained infertility have fewer follicles. However, the distribution of follicles is not uniform within the ovary and, hence, the biopsy may not represent the true follicular density.³⁸

It is understood that an invasive ovarian biopsy does not add to the information available through noninvasive modalities and it is not recommended to be used as an ORT.³⁹

KEY NOTES (THE AMERICAN SOCIETY FOR REPRODUCTIVE MEDICINE COMMITTEE OPINION, 2020)⁴⁰

- Dynamic tests such as the CCCT do not improve test accuracy for predicting poor ovarian response, pregnancy after IVF, or unassisted conception over basal markers and, therefore, should be abandoned.
- Currently, AMH and AFC are the most sensitive and reliable markers of ovarian reserve.
- Combined ORT models do not consistently improve predictive ability over that of single ovarian reserve tests.
- Markers of ovarian reserve do not predict current reproductive potential among women with unproven fertility.
- Results of ovarian reserve tests are neither useful in predicting the likelihood of unassisted pregnancy in women with infertility nor do they offer clinically meaningful improvements over already established pregnancy prediction models.
- Markers of ovarian reserve do not appear to predict pregnancy after ovarian stimulation (OS)/intrauterine insemination (IUI) for unexplained infertility.
- The ability of AMH and AFC to predict oocyte yield as well as poor and excessive ovarian responsiveness in IVF has been well demonstrated.
- Extremely low AMH values should not be used to refuse treatment in IVF.
- Anti-Müllerian hormone and AFC have only a weak association with qualitative outcomes such as oocyte quality, clinical pregnancy rates, and live birth rates.
- Poor ovarian response to maximal stimulation during IVF procedures reflects DOR, and further ovarian reserve testing is unnecessary.

REFERENCES

1. Scott RT, Hofmann GE. Prognostic assessment of ovarian reserve. *Fertil Steril.* 1995;63:1-11.
2. Hansen KR, Knowlton NS, Thyer AC, Charleston JS, Soules MR, Klein NA. A new model of reproductive aging: the decline in ovarian nongrowing follicle number from birth to menopause. *Hum Reprod.* 2008;23:699-708.
3. Padilla SL, Garcia JE. Effect of maternal age and number of in vitro fertilization procedures on pregnancy outcome. *Fertil Steril.* 1989;52:270-3.
4. Seibel MM, Kearnan M, Kiessling A. Parameters that predict success for natural cycle in vitro fertilization-embryo transfer. *Fertil Steril.* 1995;63:1251-4.
5. van Rooij IA, Broekmans FJ, Hunault CC, Scheffer GJ, Eijkemans MJ, de Jong FH, et al. Use of ovarian reserve tests for the prediction of ongoing pregnancy in couples with unexplained or mild male infertility. *Reprod Biomed Online.* 2006;12:182-90.
6. Scott RT, Toner JP, Muasher SJ, Oehninger S, Robinson S, Rosenwaks Z. Follicle-stimulating hormone levels on cycle day 3 are predictive of in vitro fertilization outcome. *Fertil Steril.* 1989;51:651-4.

7. Toner JP, Philput CB, Jones GS, Muasher SJ. Basal follicle stimulating hormone level is a better predictor of in vitro fertilization performance than age. *Fertil Steril*. 1991;55:784-91.
8. Sharif K, Elgendy M, Lashen H, Afnan M. Age and basal follicle stimulating hormone as predictors of in vitro fertilization outcome. *Br J Obstet Gynaecol*. 1998;105:107-12.
9. Erdem M, Erdem A, Gursoy R, Biberoglu K. Comparison of basal and clomiphene citrate induced FSH and inhibin B, ovarian volume and antral follicle counts as ovarian reserve tests and predictors of poor ovarian response in IVF. *J Assist Reprod Genet*. 2004;21:37-45.
10. de Bruin JP, teVelde ER. Female reproductive ageing: Concepts and consequences. In: Tulandi T, Gosden RG (Eds). *Preservation of Fertility*. London, UK: Taylor and Francis; 2004. p. 3.
11. Jain T, Soules MR, Collins JA. Comparison of basal follicle-stimulating hormone versus the clomiphene citrate challenge test for ovarian reserve screening. *Fertil Steril*. 2004;82:180-5.
12. Jayaprakasan K, Campbell B, Hopkisson J, Clewes J, Johnson I, Raine Fenning N. Establishing the intercycle variability of three-dimensional ultrasonographic predictors of ovarian reserve. *Fertil Steril*. 2008;90:2126-32.
13. Kwee J, Schats R, McDonnell J, Lambalk CB, Schoemaker J. Intercycle variability of ovarian reserve tests: results of a prospective randomized study. *Hum Reprod*. 2004;19:590-5.
14. Evers JL, Slaats P, Land JA, Dumoulin JC, Dunselman GA. Elevated levels of basal estradiol-17b predict poor response in patients with normal basal levels of follicle-stimulating hormone undergoing in vitro fertilization. *Fertil Steril*. 1998;69:1010-4.
15. Fanchin R, Taieb J, Lozano DH, Ducot B, Frydman R, Bouyer J. High reproducibility of serum anti-Müllerian hormone measurements suggests a multi-staged follicular secretion and strengthens its role in the assessment of ovarian follicular status. *Hum Reprod*. 2005;20:923-7.
16. Tsepelidis S, Devreker F, Demeestere I, Flahaut A, Gervy C, Englert Y. Stable serum levels of anti-Müllerian hormone during the menstrual cycle: a prospective study in normo-ovulatory women. *Hum Reprod*. 2007;22:1837-40.
17. La Marca A, Stabile G, Arsenio AC, Volpe A. Serum anti-Müllerian hormone throughout the human menstrual cycle. *Hum Reprod*. 2006;21:3103-7.
18. Hehenkamp WJ, Looman CW, Themmen AP, de Jong FH, te Velde ER, Broekmans FJ. Anti-Müllerian hormone levels in the spontaneous menstrual cycle do not show substantial fluctuation. *J Clin Endocrinol Metab*. 2006;91:4057-63.
19. Broer SL, Dölleman M, Opmeer BC, Fauser BC, Mol BW, Broekmans FJ. AMH and AFC as predictors of excessive response in controlled ovarian hyperstimulation: a meta-analysis. *Hum Reprod Update*. 2011;17:46-54.
20. Muttukrishna S, McGarrigle H, Wakim R, Khadum I, Ranieri DM, Serhal P. Antral follicle count, anti-Müllerian hormone and inhibin B: predictors of ovarian response in assisted reproductive technology? *BJOG*. 2005;112:1384-90.
21. Tremellen KP, Kolo M, Gilmore A, Lekamge DN. Anti-Müllerian hormone as a marker of ovarian reserve. *Aust N Z J Obstet Gynaecol*. 2005;45:20-4.
22. La Marca A, Giulini S, Tirelli A, Bertucci E, Marsella T, Xella S, et al. Anti-Müllerian hormone measurement on any day of the menstrual cycle strongly predicts ovarian response in assisted reproductive technology. *Hum Reprod*. 2007;22:766-71.
23. Nelson SM, Yates RW, Lyall H, Jamieson M, Traynor I, Gaudoin M, et al. Anti-Müllerian hormone-based approach to controlled ovarian stimulation for assisted conception. *Hum Reprod*. 2009;24:867-75.
24. Gnoth C, Schuring AN, Friol K, Tigges J, Mallmann P, Godehardt E. Relevance of anti-Müllerian hormone measurement in a routine IVF program. *Hum Reprod*. 2005;23:1359-65.

25. van den Berg MH, van Dulmen-den Broeder E, Overbeek A, Twisk JW, Schats R, van Leeuwen FE, et al. Comparison of ovarian function markers in users of hormonal contraceptives during the hormone-free interval and subsequent natural early follicular phases. *Hum Reprod.* 2010;25:1520-7.
26. de Vet A, Laven JS, de Jong FH, Themmen AP, Fauser BC. Anti-Müllerian hormone serum levels: a putative marker for ovarian aging. *Fertil Steril.* 2002;77:357-62.
27. Corson SL, Gutmann J, Batzer FR, Wallace H, Klein N, Soules MR. Inhibin-B as a test of ovarian reserve for infertile women. *Hum Reprod.* 1999;14:2818-21.
28. Hall JE, Welt CK, Cramer DW. Inhibin A and inhibin B reflect ovarian function in assisted reproduction but are less useful at predicting outcome. *Hum Reprod.* 1999;14:409-15.
29. Haadsma MA, Bukman A, Groen H, Roeloffzen EM, Groenewoud ER, Heineman MJ, et al. The number of small antral follicles (2-6 mm) determines the outcome of endocrine ovarian reserve tests in a subfertile population. *Hum Reprod.* 2007;22:1932-41.
30. Maheshwari A, Fowler P, Bhattacharya S. Assessment of ovarian reserve should we perform tests of ovarian reserve routinely? *Hum Reprod.* 2006;21:2729-35.
31. Hendriks DJ, Kwee J, Mol BW, teVelde ER, Broekmans FJ. Ultrasonography as a tool for the prediction of outcome in IVF patients: A comparative meta-analysis of ovarian volume and antral follicle count. *Fertil Steril.* 2007;87:764-75.
32. Eldar-Geva T, Ben-Chetrit A, Spitz IM, Rabinowitz R, Markowitz E, Mimoni T, et al. Dynamic assays of inhibin B, anti-Müllerian hormone and estradiol following FSH stimulation and ovarian ultrasonography as predictors of IVF outcome. *Hum Reprod.* 2005;20:3178-83.
33. Kwee J, Schats R, McDonnell J, Themmen A, de Jong F, Lambalk C. Evaluation of anti-mullerian hormone as a test for the prediction of ovarian reserve. *Fertil Steril.* 2008;90:737-43.
34. Kwee J, Elting ME, Schats R, McDonnell J, Lambalk CB. Ovarian volume and antral follicle count for the prediction of low and hyper responders with in vitro fertilization. *Reprod Biol Endocrinol.* 2007;5:9.
35. Jayaprakasan K, Hilwah N, Kendall NR, Hopkisson JF, Campbell BK, Johnson I R, et al. Does 3D ultrasound offer any advantage in the pretreatment assessment of ovarian reserve and prediction of outcome after assisted reproduction treatment? *Hum Reprod.* 2007;22:1925-31.
36. Järvelä IY, Sladkevicius P, Kelly S, Ojha K, Campbell S, Nargund G. Quantification of ovarian power Doppler signal with three-dimensional ultrasonography to predict response during in vitro fertilization. *Obstet Gynecol.* 2003;102:816-22.
37. Lass A, Silye R, Abrams DC, Krausz T, Hovatta O, Margara R, et al. Follicular density in ovarian biopsy of infertile women: a novel method to assess ovarian reserve. *Hum Reprod.* 1997;12:1028-31.
38. Schmidt KL, Byskov AG, Andersen AN, Müller J, Andersen CY. Density and distribution of primordial follicles in single pieces of cortex from 21 patients and in individual pieces of cortex from three entire human ovaries. *Hum Reprod.* 2003;18:1158-64.
39. Sharara FI, Scott RT. Assessment of ovarian reserve. Is there still a role for ovarian biopsy? First do no harm! *Hum Reprod.* 2004;19:470-1.
40. Practice Committee of the American Society for Reproductive Medicine. Testing and interpreting measures of ovarian reserve: a committee opinion. *Fertil Steril.* 2020;114:1151-7.

AMOGS Handbook on Practical Aspects of Infertility

"Live as if you were to die tomorrow
Learn as if you were to live forever"

—Mahatma Gandhi

Salient Features

- The Association of Maharashtra Obstetric and Gynaecological Societies (AMOGS) is a strong organization of gynecologists with 8000 members from all over the state
- World Health Organization (WHO) has declared infertility as a disease and the number of patients with fertility problems is rising day-by-day
- *AMOGS Handbook on Practical Aspects of Infertility* is designed as a ready reference book to tackle the day-to-day problems which gynecologists face while treating patients with infertility. The book is meticulously planned. Starting from an approach towards infertile couple, it includes advanced treatment options like role of artificial intelligence in infertility
- Experts in the field of fertility from all over Maharashtra have contributed chapters in this handbook. This book would be an integral part of day-to-day infertility practice for gynecologists practicing all over India.

Nandita Palshetkar is the President of Indian Society of Assisted Reproduction (ISAR) (2022) and Past President of Association of Maharashtra Obstetric and Gynaecological Societies (AMOGS) (2020–2022), Federation of Obstetric and Gynaecological Societies of India (FOGSI)—2019, Mumbai Obstetric and Gynaecological Society (MOGS)—2016, Indian Association of Gynaecological Endoscopists (IAGE)—2017 and FOGSI Representative to FIGO.

She is the Founder and Medical Director of Bloom IVF heading 10 IVF centers all over India. Widely considered the pioneer in assisted reproductive technology (ART) and responsible for offering the latest laboratory advances in the field to Indian patients, her passion for medicine in general and assisted reproduction in particular is well known. She has delivered over 65 orations and given several talks at national and international conferences. She has written over 100 textbook chapters, edited several books and published papers in national and international journals. She has received 18 national and international awards, including the Bharat Gaurav Award at the House of Commons in the UK. Most recently, she has been conferred the Fellowship of the Royal College of Obstetricians and Gynaecologists for her work towards the upliftment of women's health.

Chaitanya Shembekar is a renowned gynecologist, laparoscopic surgeon and fertility specialist. He is the Chairman and Managing Director, Omega Hospitals, Unit of Shembekar Hospitals Pvt Ltd, Nagpur, Maharashtra, India. He is holding a post of Chairman of Infertility Committee, the Association of Maharashtra Obstetric and Gynaecological Societies (AMOGS) and Librarian, Maharashtra Chapter of ISAR. He is a Past President of Nagpur Obstetric and Gynaecological Society. He has an accomplishment of more than two decade tenure of experience in his finesse field. He was a magnificent student and attained great felicitations during his academics. Being a perfectionist, he was awarded with a gold medal during his MBBS examination. He has done Diploma in Pelviscopy from Germany. He has been a Member of Infertility, Public Awareness and Endocrinology Committee (FOGSI), as well as the Member of Pre-Conception and Pre-Natal Diagnostic Techniques (PCPNDT) Committee, Nagpur Municipal Corporation.

He is highly treasured in the medical history and has accorded his proficiency and savvy to many institutions. He has presented research papers in various national and international conferences as well as clinical meetings. He has delivered prestigious Dr Kamini Rao YUVA FOGSI oration, Dr Kumud Tamaskar oration and many keynote address and talks in various academic meets. He has a vehement of interest in laparoscopic surgery and in vitro fertilization (IVF). He is truly intent upon promoting medical research and higher medical education. His holistic approach is to serve the humanity by his work in the medical field.

Printing Sponsored by
Om Charitable Trust

Printed in India

Available at all medical bookstores
or buy online at www.jaypeebrothers.com



JAYPEE BROTHERS
Medical Publishers (P) Ltd.
EMCA House, 23/23-B, Ansari Road,
Daryaganj, New Delhi - 110 002, INDIA
www.jaypeebrothers.com

Join us on [f facebook.com/JaypeeMedicalPublishers](https://www.facebook.com/JaypeeMedicalPublishers)

Shelving Recommendation
OBSTETRICS & GYNECOLOGY

ISBN 978-93-5465-555-5

