Based on Latest Guidelines and Updates

Includes INI-CET & NEET PG 2024 Questions

Sakshi Arora's

Self Assessment & Review

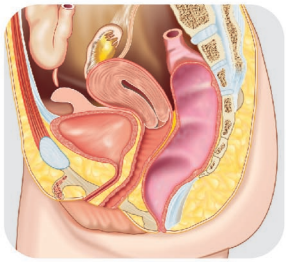
GYNECOLOGY

A must buy books for INI-CET and NEET PG exams

Thoroughly Revised & Updated from Williams's Gynecology, 4/e, Berek & Novak's Gynecology, 16/e, DC Dutta's Textbook of Gynecology, 9/e

Special Features

- Thoroughly revised and updated
- Lucid presentation of text in full color
- Includes over 162 colored illustrations/USG/HSG images/ Instruments & Specimens
- Includes New Pattern and image-based Questions
- Includes INI-CET and NEET PG questions till 2024
- Annexures for last-minute revision
- Updated FIGO guidelines on Cancer of Cervix and Vulva



Gold Standard Book for Indian & Foreign Medical UGs

14th Edition

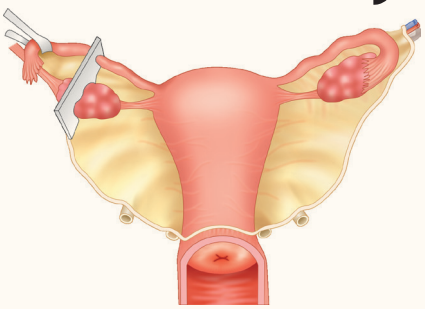
Revised by
Roshini P

JAYPEE

Contents

Most Important♦♦♦♦♦
Very Important♦♦♦♦
Important♦♦♦

CHAPTER 9



Infertility

Definitions

- **Infertility:** Failure of a couple of reproductive age to conceive even after at least 1 year of regular coitus without contraception.
  - **Primary infertility:** Infertility in a woman who has never been pregnant.
  - **Secondary infertility:** Infertility in a woman who has had one or more previous pregnancies but is now unable to conceive. Incidence is 10–15%.
- **Fecundability:** Probability of achieving pregnancy within one menstrual cycle. For a normal couple, this is approximately 25%.
- **Fecundity:** Ability to achieve a live birth within one menstrual cycle.

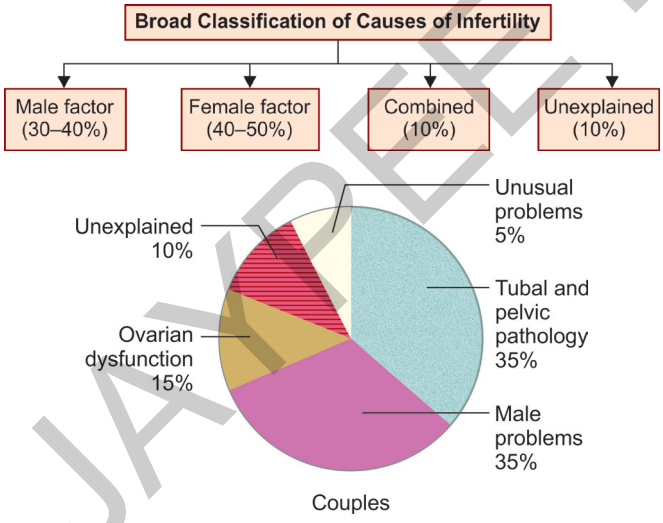


Fig. 9.1: Couples: Causes of infertility

Causes of Female Infertility

The main causes of female infertility include

- **Ovarian cause:** (i) Decreased ovarian reserve (ii) Anovulation.
- **Decreased ovarian reserve**
- **Tubal factor**
- **Uterine factor**
- **Pelvic factor**
- **Unexplained**

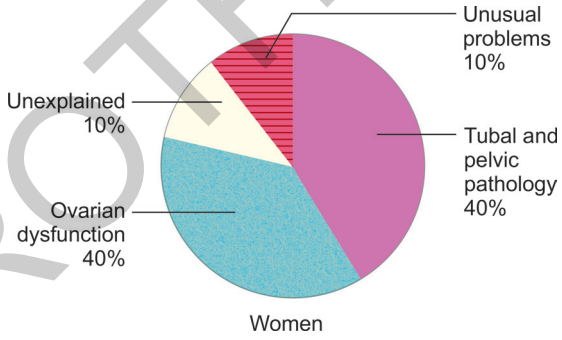


Fig. 9.2: Females: Causes of infertility

Evaluation

- Evaluation is indicated for women who fail to conceive after one or more years of regular, unprotected intercourse.
- Women over the age of 35 should be evaluated sooner (i.e., after 6 months of regular, unprotected intercourse).
- No woman should be denied her request for infertility services or counseling, regardless of duration.
- Successful reproduction requires proper structure and function of the entire reproductive axis, including hypothalamus, pituitary gland, ovaries, fallopian tube, uterus, cervix, and vagina.

- **Infertility evaluation** comprises eight major elements:
  - History and physical examination
  - Semen analysis (first investigation)
  - Sperm–cervical mucus interaction [postcoital testing (PCT)]–for select patients
  - Assessment of ovarian reserve
  - Tests for occurrence of ovulation
  - Evaluation of tubal potency
  - Detection of uterine abnormalities

- With proper coordination, the evaluation can be completed within one menstrual cycle. No abnormality or cause of infertility can be identified in 10% to 15% of couples. This group comprises a category known as "unexplained infertility."

Male Infertility

Male factor is the only cause of infertility in about 20% of infertile couples but it a contributing cause in 50% case.

Physiology of Sperm Formation in Males

- **Testis has 2 compartments:**
  - **Seminiferous tubule:** Has Sertoli cells where spermatogenesis takes place
  - **Interstitial tissue:** Has Leydig cells which secretes testosterone
- Spermatogenesis occurs in Sertoli cells and takes 74–75 days to complete.
- All 3 hormones LH, FSH and Testosterone are needed for spermatogenesis. But the main hormone needed is Testosterone. (Fig. 9.3)

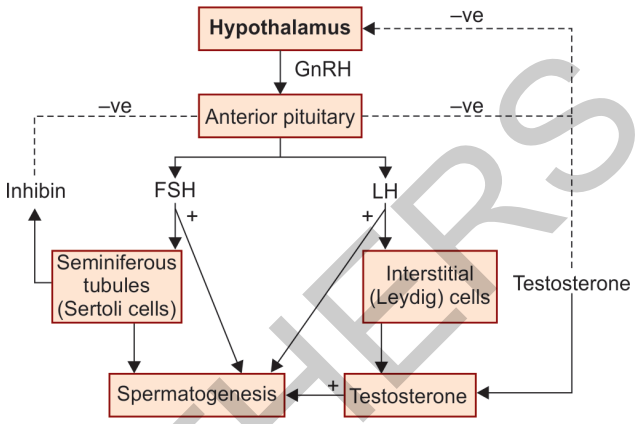
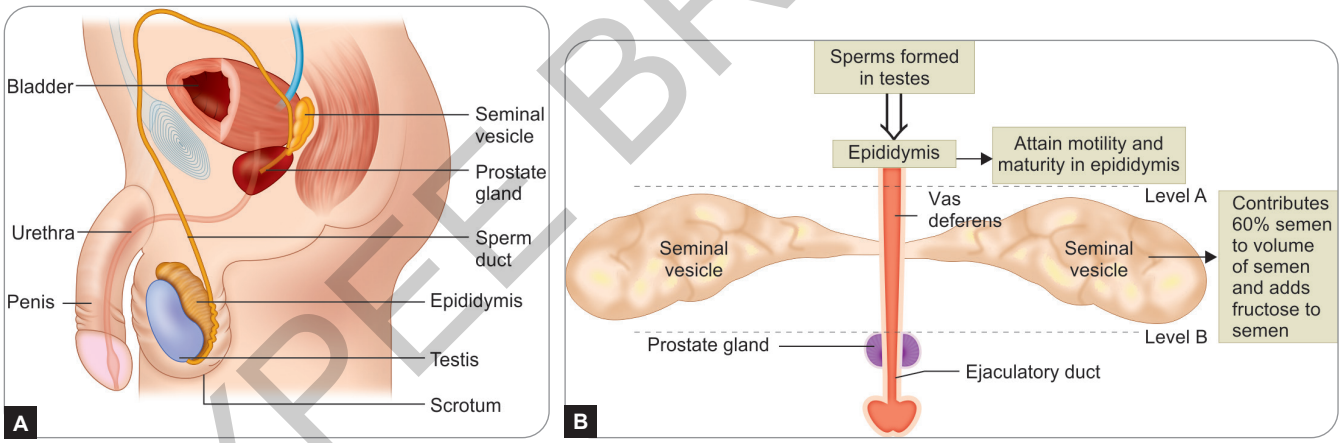


Fig. 9.3: Hypothalamus pituitary testis axis in males

- The resultant spermotozoa are released into the seminiferous tubule lumen and then enter the epididymis where they mature and become motile. They take 7–10 days to transverse this tortous structure and reach the vas deferens.



Figs. 9.4A and B: Sperm pathway

- The fluid from seminal vesicle **fluid contributes 60% of the semen volume. Seminal vesicle fluid contains large amount of fructose, which is used by the sperm mitochondria to generate ATP to allow movement through female** genital tract.
- Now after this prostate Gland adds its secretion to the semen and then at the time of ejaculation, bulbourethral gland gives its secretion. The sperms and semen pass into ejaculation duct is ejaculate out.
- The released semen is a gelatinous mixture of spermatozoa and seminal plasma: However, it thins out 20 to 30 minutes after ejaculation. This process, called **liquefaction, is the** direct result of proteolytic enzymes within the prostatic fluid.
- Following ejaculation, the released spermatozoa must undergo capacitation to become competent to fertilize the oocyte.
- Capacitation starts in the cervix and most importantly occurs in fallopian tube.
- Sperm transport from the posterior vaginal fornix to the fallopian tubes occurs within 2 minutes during the follicular phase of the menstrual cycle.

Also Know

The sertoli cells are supporting cells also called as **sustentacular cells** and they surround all stages of the developing sperm cells (Fig. 9.5).
The tight junction between these sertoli cells create the **blood testis barrier** which keeps the blood borne toxins from reaching the germ cells and at the same time keeps surface antigens on the developing germ cells from escaping into the bloodstream and prompting an autoimmune response.

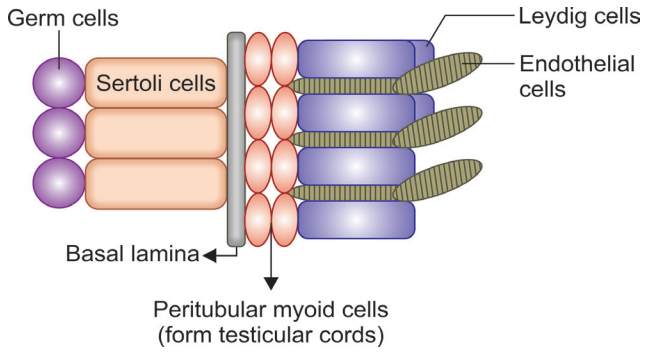


Fig. 9.5: Blood testis barrier

Investigation of male infertility

Semen Analysis

It is the first investigation to be done when a couple comes with the complaint of infertility. Abstinence of 3 days is needed

Normal parameters of semen Analysis (WHO–2010)

Normal parameters of semen analysis (WHO–2010)	
Semen analysis	**Minimum (Normal values)**
Volume	≥1.5 mL
pH	7.2–7.8
Viscosity	<3 (scale 0–4)
Sperm concentration	≥15 million/mL
Total sperm count	39 million/ejaculate
Motility	Progressive motility : 32%
	Total motility ≥40
Morphology	Normal forms 4%
Viability	Living 58%
Leucocytes	Less than 1 million/mL
Round cells	< 5 million/mL
Sperm agglutination	< 10% spermatozoa with adherent particles

Most important criteria in semen analysis is sperm morphology > sperm motility > sperm concentration

Other Important Values in Semen Analysis

- pH = > 7.2 (between 7.2 and 7.8)
- Round cells (including WBC + epithelial cells + immature cells) = < 5 million/mL.
- Sperm agglutination = <2

Extra Edge

- When no motile sperms are observed a **sperm viability** test differentiates viable or non motile sperms from dead sperms.
- Round cells in semen analysis includes epithelial cells, prostate cells, immature sperms (spermatogonia, round spermatids, spermatocytes) and leucocytes. If total round cells is > 5 million/mL it is abnormal. True leukocytospermia means > 1 million leukocytes/mL and requires semen culture for Mycoplasma hominis, Ureaplasma urealyticum and Chlamydia.
- Lymphocytes can be distinguished from other cells by immunoperoxide staining **"Endtz Test".**

Terminology related to semen analysis

Normospermia	All semen parameters normal
Oligozoospermia[Q] / oligospermia	Decreased sperm number < 20 million/mL
Asthenozoospermia[Q] / asthenospermia	Decreased sperm motility[Q]
Teratozoospermia[Q]	Increased abnormal forms of sperm[Q]
Oligoasthenoterato-zoospermia	All sperm variables abnormal[Q]
Azoospermia[Q]	No sperm in semen[Q]
Aspermia	No ejaculate (ejaculation failure)
Leucocytospermia[Q]	Increased white cells in semen[Q]
Necrozoospermia[Q]	All sperms non-viable or non-motile[Q]

Note: If no spermatozoa are observed in wet preparation, WHO recommends an examination of centrifuged sample (3000 × g or greater for 15 minutes). If no sperms are observed in the centrifuged sample, the semen analysis should be repeated. The presence of a small number of sperms in either of centrifuged sample is defined as **cryptozoospermia** and complete absence is called as **azoospermia.**

Causes of Male Infertility

All causes of male infertility can be classified as:

1. **Pre-testicular cause** i.e. involving Hypothalamus or Pituitary
2. **Testicular cause** i.e. involving testis
3. **Post-testicular cause** i.e. below level of testis (Flowchart 9.1)

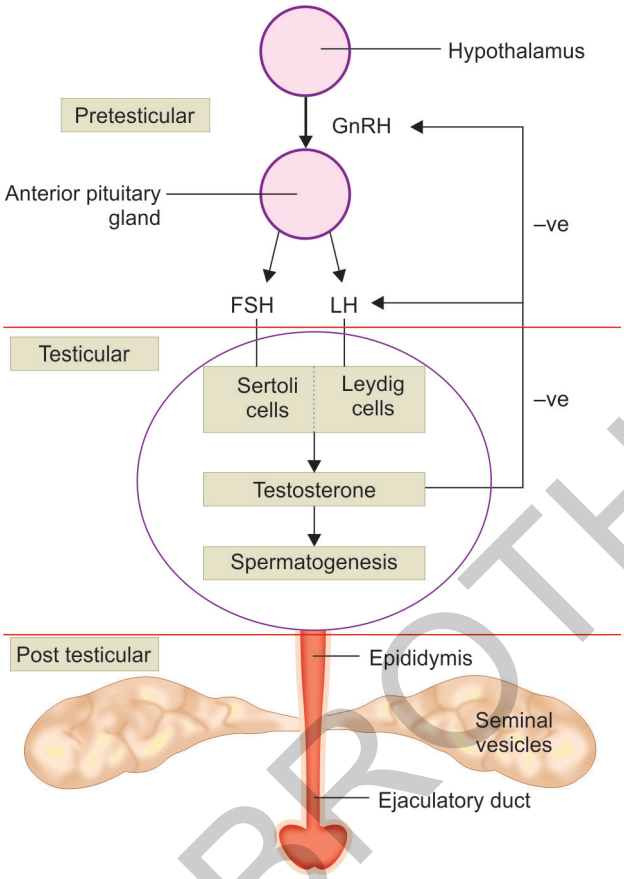


Fig. 9.6: Causes of male infertility.

Flowchart 9.1: Causes of male infertility

Common causes of Male Infertility

Pretesticular

- Endocrine
  - Gonadotropin deficiency
  - Thyroid dysfunction
  - Hyperprolactinaemia
- Psychosexual
- Drugs
  - Antihypertensives
  - Antipsychotics
- Genetic
  - 47 XXY (Klinefelter)
  - Y chromosome deletions
  - Kallmann syndrome

T1 = LH:↓
= FSH:↓
Hence
Testosterone:↓

Testicular

- Immotile cilia syndrome
- Cryptorchidism
- Infection (mumps orchitis)
- Toxins (drugs, radiation)
- Primary testicular failure
- Sertoli cell-only syndrome

Testosterone:↓
so negative feedback on LH and FSH gone
So LH↑
FSH↑

Post-testicular

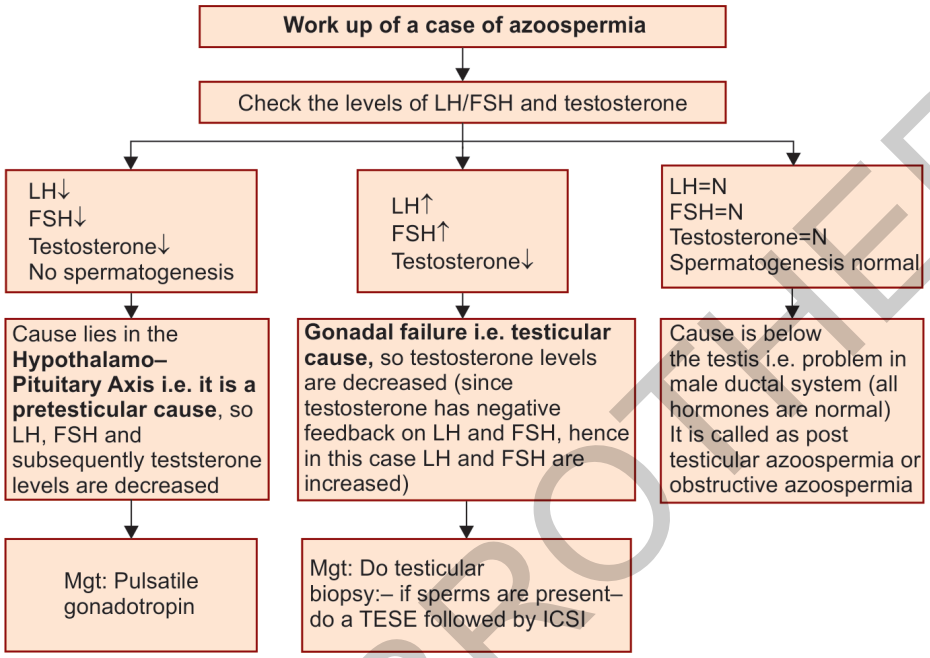
- Obstruction of efferent duct
  - Congenital
    - Absence of vas deferens
    - Young's syndrome
  - Acquired
    - Surgical
      - Vasectomy
- Others
  - Ejaculatory failure
  - Bladder neck surgery
  - Retrograde ejaculation

FSH: Normal
Testosterone: Normal

Azoospermia

In patient with azoospermia workup as shown in Flowchart 9.2 is done.

Flowchart 9.2



Note: Always in men who have low semen volume rule out Retrograde ejaculation.
In case of obstructive azoospermia, spermatogenesis occurs normally so it will have the best prognosis.

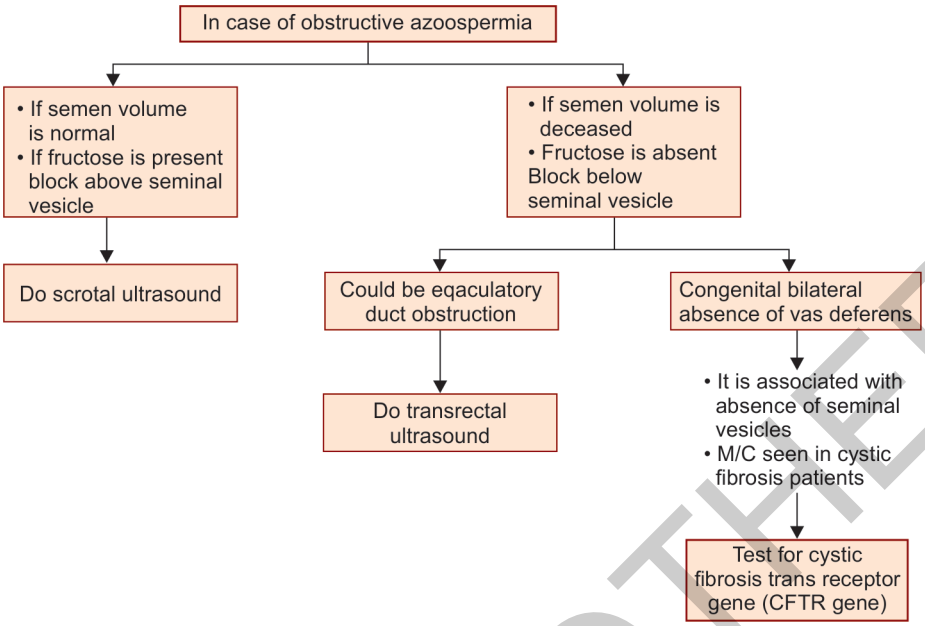
Important Concept

A very important question and very frequently asked in all exams is to find out the site of block in case of azoospermia.
Now for all questions like these:
Check the levels of FSH and testosterone.

Hormone Levels	Site of Problem
FSH ↓ Testosterone ↓	Hypothalamus or Pituitary
FSH ↑ Testosterone ↓	Testis
FSH N Testosterone N	Problem is below the testis called as **obstructive azoospermia**

In case of obstructive azoospermia:

- The site of block can be determined by seeing whether Fructose is present or absent in semen
- As seen in Fig. 9.4B seminal vesicles add fluid (which accounts for 60% of semen) and fructose to it
  (i) **So if block is below the level of seminal vessicles (Level B shown in Fig. 9.4B): There will be**
  Then when the man will ejaculate its semen will have fluid from bulbourethral Gland and prostate Gland.
  It will not have fluid from seminal vesicle, hence fructose will be absent and semen will be low in volume. It will not have sperms (i.e. azoospermia).
  (ii) **If block is above the level of seminal vesicle (Level A) shown in Fig. 9.4B):**
  Then when the male ejaculates his semen will have:
  Fluid from seminal vessicle hence it will be of good volume and fructose will be present
  Fluid from prostate Gland
  Fluid from bulbourethral Gland the semen **will not** have—sperms (i.e. azoospermia).



Management of Obstructive Azoospermia

In case of obstructive azoospermia, although sperms are absent in semen due to obstruction, they are present in the testis as in testis spermatogenesis is normal.

Sperms can be retrieved from testis or epididymis by following surgical techniques:

TESA	Percutaneous testicular sperm aspiration
TESE	Testicular sperm extraction
MESA	Microsurgical epididymal sperm aspiration
PESA	Percutaneous epididymal sperm aspiration

The recovered sperms are then injected into the **oocyte by ICSI** (explained latter).

Note: Repeat retrieval should be done after 3–6 months.

In case of Testicular azoospermia — there are slight chances of pregnancies; if sperms can be retrieved from the testis using retrieval method followed by ICSI.

Epididymal aspiration is not an option in them.

Management Options in Decreased Sperm Count in Males

Sperm count	Management
Oligospermia = Sperm count 10–15 million/mL	IUI
Sperm count = **5–10 million/mL**	IVF
In case of **severe oligospermia (< 5 million/mL)**	ICSI

Intrauterine Insemination (IUI)

Intrauterine insemination is placement of 0.3 to 0.5 mL of washed processed and concentrated sperms (devoid of seminal plasma/semen) into the intrauterine cavity **by transcervical catheterization.**

KEY POINTS

Prerequisite for IUI:

- Fallopian tube of the female should be patent so IUI cannot be done in tubal infertility in females
- Total number of motile sperms should be more than 10 million and 14% of sperms should have normal morphology

Methods of processing the sperm:

1. Swim up technique (Most commonly used)
2. Swim down technique
3. Density centrifugation technique (Best)

The purpose of IUI is to bypass endocervical canal and to place increased number of motile sperms close to fallopian tube.

Components of the ejaculate removed in IUI include seminal fluid, excess debris, leukocytes and morphologically abnormal sperms. Best results are achieved when the final specimen contains 10 million total motile sperms.

IUI done with husband sperm is IUI-H and with donor sperm is IUI-D.

Indications

Intrauterine insemination is done in **males** with:

- Severe hypospadias, epispadias
- Retrograde ejaculation (Immediate postcoital urine is taken and sperms are extracted from it.)
- Neurogenic impotence
- Sexual dysfunction
- Oligospermia with sperm count 10–15 million/mL.
- Low ejaculate volume (IUI + clomiphene × 2 cycles).

In female infertility IUI is useful in:

- Cervical infertility–Antisperm antibodies are present in cervix
- Vaginismus (involuntary contraction of perineal muscles during intercourse)
- Unexplained infertility. (IUI + clomiphene × 3 cycles).

Procedure

Patient is laid in supine position and an insemination catheter is inserted in cervical canal and is advanced slowly in the uterine cavity. 0.5 mL of semen is slowly introduced and patient is then asked to lay supine for 15 minutes.

Timing for IUI

- In natural and clomiphene stimulated cycles, urinary LH monitoring should be started 3 days before expected ovulation and insemination done on the day after midcycle urinary LH surge or IUI is done on 5 and 7 days after completion of clomiphene.
- If ovulation is triggered by exogenous hCG, IUI is performed 36 hours later.

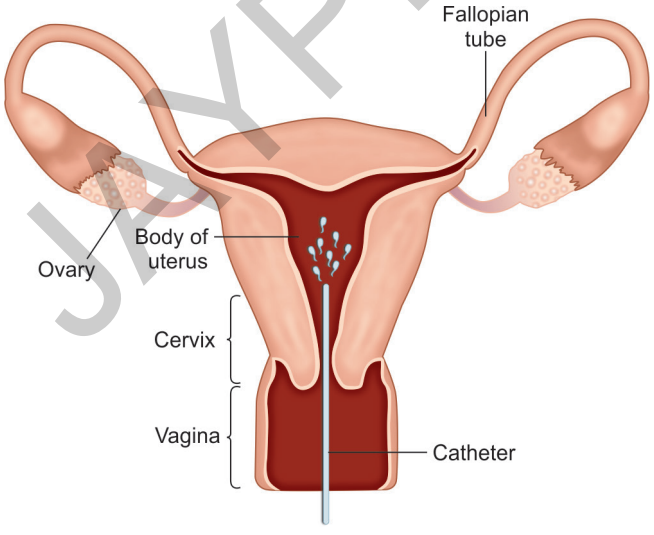


Fig. 9.7: IUI

IVF (In Vitro Fertilization)

Indications

In females:

- Tubal disease best is for distal tube obstruction
- Endometriosis leading to infertility
- In case of decreased ovarian reserve using donor oocyte
- In Mullerian agenesis – using IVF followed by surrogacy
- If female has a risk of transferring a genetic disease then IVF with pre- implantation genetic diagnosis is done

In males:

- For oligospermia (sperm count 5–15 million/mL)
- Unexplained infertility

KEY POINTS

- **Most important parameter for IVF**-Motility of sperms.
- **Most important parameter for ICSI**- Morphology of sperms

ICSI: Intracytoplasmic Sperm Injection

Indications

- Female indications same like IVF

Male:

- For severe oligospermia sperm count < 5 million/mL
- Motility of sperms < 5%
- Whenever sperms are retrieved surgically using techniques of MESA/PESA/TESA/TESE
- In case of IVF failure

Procedure: Common for IVF and ICSI

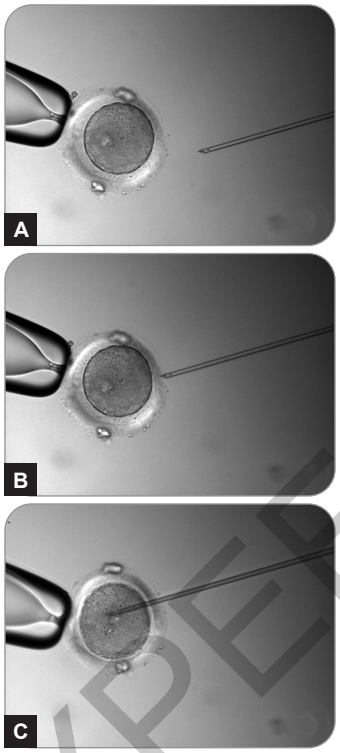
- Semen is collected, washed processed like in IUI and incubated in media for 3–4 hours to promote sperm capacitation and acrosome reaction.
- **To the female partner:** Ovulation inducing drugs like clomiphene or gonadotropins are given so that she hyperovulates. This is followed by follicular monitoring from D10 onwards. When at least 2 follicles are 17–18 mm in size or larger (but not more than 24 mm) and endometrial thickness is 8 mm or more, injection hCG is given as **ovulation trigger.** This is because hCG and LH are functionally similar.
- Oocyte retrieval is done via TVS under general anesthesia. Prophylactic antibiotics are recommended at the time of retrieval oocyte. Retrieval should be done 36 hrs after hCG injection.

In IVF

- Now **50,000 to 1,50,000** motile sperm are inseminated for each oocyte in a small droplet of media under oil.

In ICSI (Figs. 9.8A to C)

- Here the aspirated oocyte is stipped off its follicular cells, followed by insertion of a single sperm into the cytoplasm of the mature metaphase II egg.
- Hence in ICSI for 1 oocyte, only 1 sperm is needed. That is why this procedure can be done in severe oligospermia or in azoospermia when sperms are surgically retrieved from testes.



Figs. 9.8A to C: Intracytoplasmic sperm injection (ICSI) procedure: (A) The holding (left) and the injecting (right) pipettes are seen; (B) The oolemma is penetrated; (C) The injection pipette has reached nearly the center of the oocyte

Common Steps for Both IVF & ICSI Continued

- Once the fertilization occurs, either by IVF or by ICSI, it is known by presence of 2 pronuclei and extrusion of second polar body. The embryos are cultured. Embryos are incubated in atmosphere of ≤ 5% CO_2 and 37°C temperature. Various culture media are used.
- The embryo transfer can be done at **cleavage stage or** 8 **cell stage** i.e. day 3 or **at blastocyst stage** (i.e. day 5). Blastocyst transfer is associated with lower implantation failure, higher pregnancy rate and 7% higher live birth.
- It is done transcervically using TAS to ensure that embryos are **transferred 1.5 to 2 cm below the fundus of uterus. (As this is the site for implantation)**
- Success rate with single embryo = 30%
- Cumulative success rate = 40–50%

FEMALE INFERTILITY

A–Ovarian Cause (40% Cases)

The 2 major causes of ovarian infertility in females are:
1. Anovulation e.g. PCOS.
2. Decreased ovarian reserve e.g. premature menopause

WHO classifications of ovarian causes of infertility

Class I (10%):	Hypothalamic pituitary failure (Hypogonadotrophic hypogonadism) e.g. Kallman syndrome
Class II (85%):	Hypothalamic pituitary ovarian dysfunction e.g. PCOS (Anovulation) (Most easily treatable form of infertility) hyperprolactinaemia
Class III (5%):	Ovarian failure (premature menopause).

1. Anovulation

It is the most easily reversible and treatable cause of female infertility.

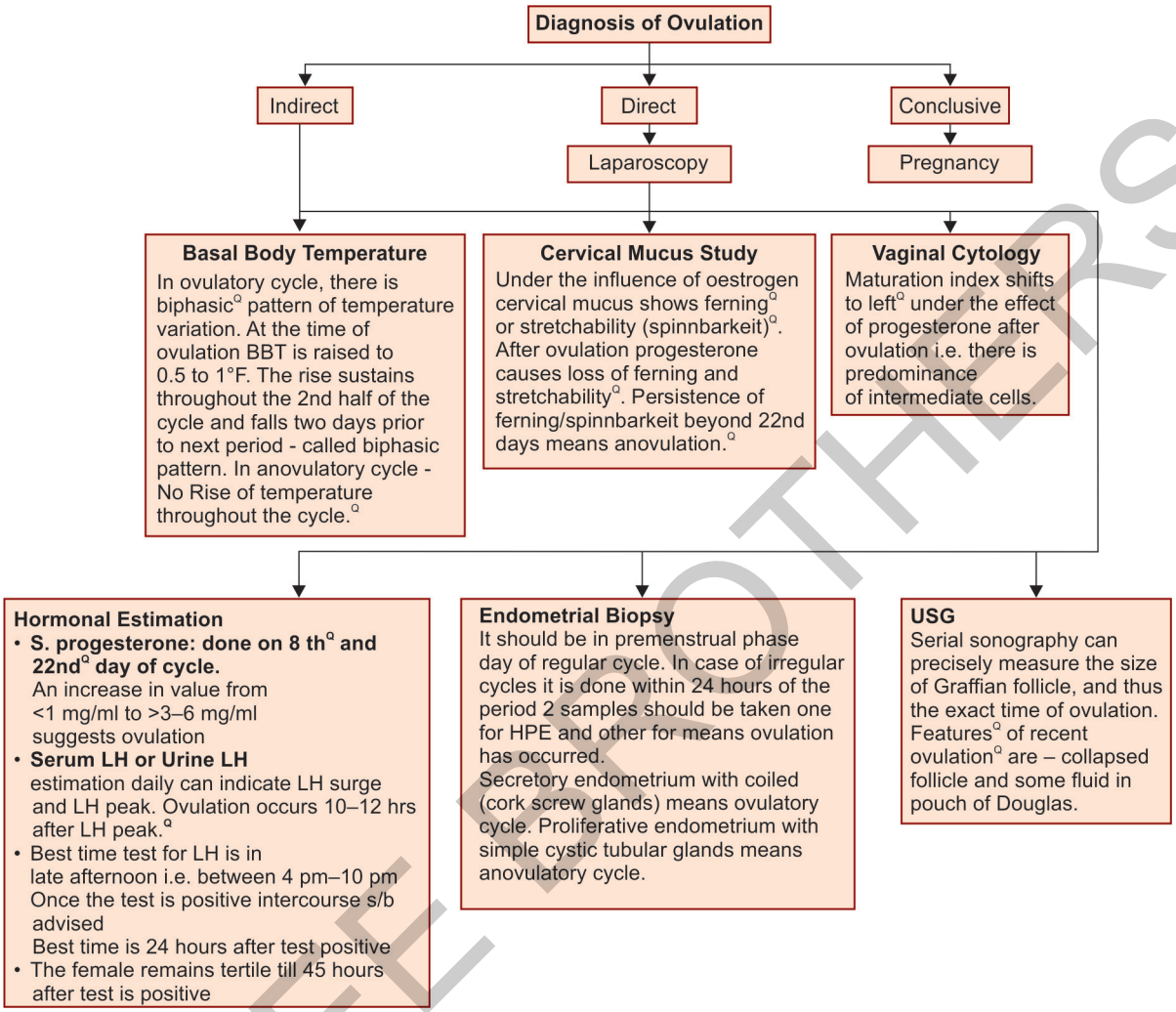
Diagnosis

- This is based on the fact that:
  - It female ovulates: Progesterone will be present
  - If female does not ovulate: Progesterone will be absent
- Since maximum level of progesterone are seen on day 22 of cycle when activity of corpus luteum is maximum, hence all the tests of ovulation are done on day 22 of cycle (if cycle is regular) or 1 week before menstruation (if cycle is irregular).

For diagnosis of anovulation see Flowchart 9.3.

Note:
1. **Endometrial Biopsy** is an invasive procedure & now a days not the best test done for ovulation. But there are certain advantages of endometrial biopsy:
   i. It can help in diagnosing luteal phase defect (i.e. a condition where levels of progesterone are less than normal)
   ii. Genital TB
   - The first sign of ovulation on endometrial biopsy is subnuclear vacuoles.

Flowchart 9.3



Note: Apart from all the Indirect evidences of ovulation discussed above, if a female has dysmenorrhea that also indicates ovulatory cycle. Pain is absent in anovulatory cycles.

2. **Best investigation for anovulation:** Hormone estimation
   i. If one wants to know only that whether a female has ovulated or not then, S. progesterone level estimation is done.
   ii. If one wants to know the time at which ovulation occurs – serum LH estimation is done
3. M/C done test for ovulation - Follicular monitoring on TVS.

Signs of Ovulation on USG

- Size of follicle increases by 2-3 mm everyday till it becomes 18-20 mm in size and then it suddenly decreases.
- Some fluid is seen in pouch of Douglas
- Endometrium appears triple layered/TRILAMINAR appearance (Fig. 9.9)

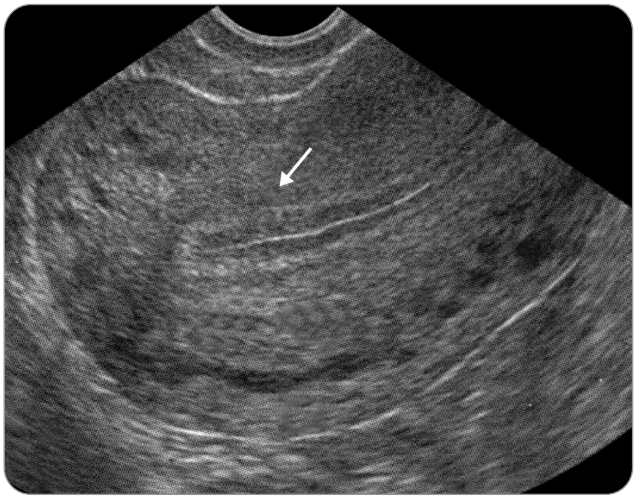


Fig. 9.9: Ultrasound showing triple layered appearance of endometrium

Management

Management of Anovulation is by ovulation induction. Ovulation induction aims at the release of one egg per cycle in a woman who has not been ovulating regularly.

Ovulation Inducing Agents

1st line drugs for anovulation

(i) Letrozole (Best)

(ii) Clomiphene citrate (2nd best):

- Nowadays the DOC for anovulation is Letrozole.
- Earlier there was a ban on use of letrozole but now it has been removed & letrozole is considered as DOC for PCOD/PCOS.
- The first step in all patients with PCOD/anovulation is to advise them weight reduction.
- Weight reduction in itself restores ovulation in some cases.
- Weight reduction can be achieved by:
  - Diet modification
  - Physical exercise
  - Bariatric surgery
- The ideal time to conceive after bariatric surgery is after 12-18 months.
- If patient has insulin resistance, then along with clomiphene citrate or letrozole, add metformin.
- If patient has hyperprolactinemia, then along with clomiphene citrate or letrozole, add cabergoline.

Comparative analysis of Letrozole and Clomiphene

	Clomiphene	Letrozole
Mechanism of action	SERM	Aromatase inhibitor
Half life	Long 5–7 days	Short 45 hrs
Anti-estrogenic effects	Clomiphene has anti-estrogenic effects Thin endometrium and altered cervical mucus	Letrozole does not have anti-estrogenic effects Thick endometrium and favourable cervical mucus
Uterine blood flow	↓	↑
Ovulation rate Pregnancy rate	60–85% 10–12% per cycle	70–80% 10–15% per cycle
Multiple pregnancy rate	High	Low
OHSS	High	Low

Hence, first choice drug for ovulation induction is Letrozole (as per ACOG guidelines)

Note: If Letrozole is not given in options then mark clomiphene.

Dose of Letrozole = 2.5 mg/day

Maximum dose = 7.5 mg/day

To be given from D3-D7

Clomiphene Citrate

Clomiphene Citrate: It is a racemic mixture of enclomiphene and zuclomiphene. Enclomiphene is a more potent isomer responsible for its ovulation-inducing action.

- **Dose** = 50–250 mg. The US FDA-approved maximum dose for clomiphene citrate is 100 mg. **Maximum approved time** = 1 year
  Initial dose = 50 mg × 5 days (either from D2 to D6 or D5 to D9)
- Clomiphene blocks "Estrogen" receptors, so negative feedback on FSH gone so levels of FSH → increase from pituitary, which leads to growth of multiple follicles hence multiple pregnancy.
- Thus it can be used **only in patients with intact hypothalamic –pituitary ovarian axis**
- From D10 follicular monitoring is done and as the follicles reach 18–20 mm size, **hCG injection is given as ovulation trigger.**

KEY POINTS

hCG is functionally and structurally similar to LH hence giving hCG injection creates LH surge like condition.

- Ovulation occurs in 80% cases
- After 32 to 36 hours of inj hCG, IUI is done.

Side Effects of Clomiphene

- Multiple pregnancy: Rate 5–8% (< 10%)
- Menopausal symptoms–like vasomotor symptoms (Hot flashes)–(M/C side effect).
- Risk of ovarian hyperstimulation syndrome (< 1%)
- Ovarian cyst formation
- Visual symptoms—**If visual symptoms occur, its use should be immediately discontinued**
- As it leads to hyperovulation, it increases chances of ovarian cancer.

KEY POINTS

- Clomiphene is not teratogenic but it is classified as category X drug by FDA and is C/I in suspected pregnancy.
- Clomiphene doesn't increase the risk of ectopic pregnancy.

2nd Line Drug for Anovulation

Gonadotropins: HMG (Human Menopausal Gonadotropin) is obtained from the urine of the menopausal women.

- Menopausal women have high FSH and LH levels in their blood and urine, and HMG is extracted from urine of menopausal females.
- Dose of HMG = 130–300 IU daily
- Maximum dose = 450 IU for superovulation
- With HMG the chances of multiple pregnancy are 30% and OHSS are 5%.

3rd Line Drug

GnRH: Synthetic GnRH can be given in a pulsatile manner for ovulation induction and as treatment for delayed puberty. GnRH agonist can be given for maximum 6 months, because they cause significant osteoporosis. If it has to be continued for more than 6 months, then add back therapy should be given.

Ovarian Hyperstimulation Syndrome

Background

All ovulation inducing drugs, directly or indirectly increase FSH which in turn stimulates a number of follicles. The granulosa cells of the follicles secrete Estrogen.

Estrogen (E2) secreted per follicle = 150-200 pg/mL

Hence if the number of follicles increase, the levels of E2 increase.

- If estrogen ≥ 3500 pg/mL, the chances of OHSS are 1.5%.
- If estrogen ≥ 6000 pg/mL, the chances of OHSS are 38%.

What is OHSS

This is a clinical symptom complex associated with ovarian enlargement resulting from exogenous gonadotropin therapy.

Pathophysiology

The increased estrogen levels increase vascular endothelial growth factor (VEGF) which increases vascular permeability and loss of fluid, protein and electrolytes into the peritoneal cavity which leads to hemoconcentration.

- Another factor involved is Angiotensin II.
- There is also associated electrolyte imbalance.
- Due to hemoconcentration, hematocrit increases & there are increased chances of thromboembolic events.
- As the size of ovary increases due to enlarged follicles, there are chances of torsion, rupture and haemorrhage of ovary.

Risk Factors for OHSS

- Young female
- Female has PCOS
- Injection hCG – it triggers OHSS.

Symptoms

Abdominal pain is the most prominent symptom caused by ovarian enlargement and accumulation of peritoneal fluid.

Due to leakage of fluid to third space, it can lead to ascites, pleural effusion, edema, etc. Due to decreased intravascular volume there can be decreased urinary output, hypovolemic and renal failure.

Grading

Grade 1: Abdominal distension
Grade 2: Abdominal distension +
Nausea/vomiting or diarrhea
Size of ovary = 6–12 cms
Grade 3: Ascites present on ultrasound
Grade 4: Clinical evidence of ascites/hydrothorax/difficult breathing
Grade 5: Findings of grade 4 with evidence of hemoconcentration, coagulation abnormalities and decreased renal perfusion.

KEY POINTS

In all cases of ovulation induction, injection hCG is given as an ovulation trigger.

Ideal condition for injection hCG

- E2 levels = 450–1000 pg/mL
- 1–2 follicles ≥ 16 mm in size
- Endometrial thickness = 8 mm

BUT

Injection hCG also triggers OHSS if Estrogen levels are very high
E2 ≥ 3500 pg/mL -> chances of OHSS are 1.5%
E2 ≥ 6000 pg/mL -> chances of OHSS are 30%

Hence to prevent OHSS

- Delay hCG injection
- Withhold hCG injection (if E2 ≥ 5000 pg/mL or if follicles are ≥ 13 in number)
- Decrease the dose of hCG from 10,000 IU to 5000 IU.
- Cancel the cycle (in grade 3, 4, 5 of OHSS)
- Give cabergoline as it decreases VEGF.

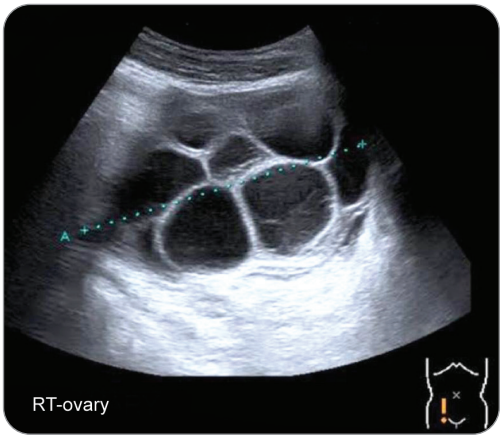


Fig. 9.10: USG of OHSS

Management

- Admit the patient
- 1st line treatment - correction of hypovolemia by IV fluids or colloids
- In case of tense ascites – Paracentesis is done
- Prophylactic heparin to reduce the risk of thrombo-embolism.

2. Decreased Ovarian Reserve

Decreased ovarian reserve, i.e. less number of follicles in the ovary is the second ovarian cause of female infertility.

Ovarian reserve tests are to assess the quantity as well as the quality of primordial follicles present in the women's ovary. These tests are done to determine how the ovaries will respond to therapy (ovulation induction). In other words it is the assessment of the reproductive potential of the woman.

Tests for Ovarian Reserve

1. **Serum Day 3 FSH levels**
   Basis of Test: As the number of follicles decrease serum estrogen decreases so negative feedback on FSH is lost, hence serum FSH levels increase.

FSH levels
- Normal = 0–10 IU
- Borderline = 10–15 IU
- Poor ovarian reserve = ≥ 15 IU
- Suggestive of premature ovarian failure = ≥ 20 IU
- Diagnostic of premature ovarian failure = ≥ 40 IU

2. **Serum Inhibin B levels:**
   In poor ovarian reserve patients, levels of Inhibin B on Day 3 are less than 45 pg/mL as Inhibin is secreted by granulosa cells of the follicle
3. **Clomiphene citrate challenge test:**
   In this case FSH levels are measured on Day 3 of the cycle and again on Day 10 after administering clomiphene citrate (100 mg orally each day) from Day 5 to Day 9.
   The Day 3 levels of FSH are increased in patients of poor ovarian reserve and further increase on Day 10 after clomiphene
4. **Serum antimüllerian hormone (AMH)**: Levels of serum AMH is a good predictor of ovarian stimulation response. Levels of AMH (< 0.5 ng/mL) decline with age and with poor ovarian reserve. Levels of AMH can be measured any time in the menstrual cycle, hence it is **the best test for ovarian reserve.**

AMH: AMH is produced by the granulosa cells of the preantral small follicles. Serum levels of estradiol and inhibin B depend on pituitary FSH feedback mechanism. Level of AMH is not dependent on feedback mechanism.

This is one of the reasons for which AMH is a better predictor of ovarian reserve compared to estradiol and inhibin B. Levels of AMH can be measured at anytime in the menstrual cycle.

5. **Antral Follicle Count (AFC)** is done by using TVS in early follicular phase in both the ovaries. AFC reflects qualitative the primordial follicular pool in the ovary. It is done between D2–D4 of cycle.
   - AFC more than 6 in each ovary (2–10 mm size) reflects adequate ovarian follicular reserve.
   - AFC, less than 4, indicates poor ovarian reserve and poor response to ovarian stimulation during IVF.
   - In both ovaries if follicles are <10, it reflects poor ovarian reserve.
   - AFC decreases with age.

KEY POINTS
AFC is the best quantitative marker of ovarian reserve.
AMH is the best overall marker of ovarian reserve.

6. **Serum estradiol levels:** Per se it does carry any significance. But if the levels are correlated along with FSH levels then it has significance.

Management

In poor ovarian reserve cases the female will not have her own eggs so she can become pregnant by using donor oocytes followed by IVF.

Tubal Factors

Tubal factors leading to infertility include endometriosis, pelvic adhesion disease or previous bilateral tubal ligation. These conditions lead to blockage of tube.

The block could be at the level of:
- Proximal block
- Mid segmental block
- Distal block

The problem is if only both the tubes are blocked. Unilateral block does not need treatment.

Tests for Detecting Tubal Potency

Investigation of Choice—Hysterosalpingography (HSG)

- **Hysterosalpingogram (HSG)** assesses uterine and fallopian tube contour and tubal patency. It shows Mullerian anomalies as well as most endometrial polyps, synechiae and submucosal fibroids.
  - Performed in the early follicular phase, D 10 of the cycle to minimize chances of interrupting a possible pregnancy.

Sakshi Arora's Self Assessment & Review
GYNECOLOGY

The 14th edition of the book covers the entire Gynecology in a simple holistic approach to cater for the needs of postgraduate aspirants as well as undergraduate students of India and abroad. After a high-yield synopsis of topics in each chapter, there are detailed explanations of the MCQs from NEET PG & INI-CET (2000-2024).

Keeping in mind the recent trend, New Pattern Questions, NEET Pattern Questions, Image-based questions and color images of instruments, specimens and radiology are included to enhance the utility of the book. This 14th edition includes Annexures for last minute revision. A brief description of instruments is added along with the photograph to help not only the postgraduate aspirants but also the undergraduate students during their viva voce.

A Must Read for:

- Undergraduates
- Foreign medical graduates
- Interns and Post-interns
- All postgraduate medical aspirants
- Any exam of Gynecology

FEATURES	SELF ASSESSMENT & REVIEW—GYNECOLOGY	POPULAR BOOKS
Subject specialty	✓	✓
Coverage of topics	Extensive (covers the entire gynecology)	Selective
Number of questions	Over 3000 questions explained	Around 400
NEET pattern questions	More than 500	×
New pattern questions	Included	Not-included
Questions' coverage	2000–2024	–
Recent papers of INI-CET (2024)	Added	×
Fully colored	✓	×
Image-based questions	✓	×
Ultrasound	✓	×
Pap smear images	✓	×

Printed in India

Available at all medical bookstores or buy online at www.ejaypee.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 facebook.com/JaypeeMedicalPublishers
Follow us on instagram.com/JaypeeMedicalPublishers

Shelving Recommendation
GYNECOLOGY

ISBN 978-93-6616-268-3
9 789366 162683