



UNIVERSITY OF ILORIN TEACHING HOSPITAL,
Ilorin, Nigeria.

Fertility Treatment Protocols

On

Assisted Reproductive
Technology



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Infertility is widespread in the developing world. In general, infertility includes inability to impregnate, conceive or pregnancy wastage by spontaneous abortion or stillbirth. Infertility has reached such an alarming level that so much hype is being made about it in the media. There is an urgent need to increase research into the causes and cures of infertility in Nigeria.

The Management of the University of Ilorin Teaching Hospital under my stewardship has made a giant stride in creating a conducive environment for research and training in infertility treatment at the Assisted Reproductive Technology Unit of the hospital.

Sophisticated medical techniques for treating infertility are now available at the UITH IVF Centre far beyond the conventional fertility treatment in the gynaecological department of the hospital.

With this Fertility Treatment Protocols, the ART Unit has pragmatically demystified the treatment of infertility. Numerous testimonies of couples, home and abroad, that have benefited from our certified fertility care services are clear undisputable evidence of the efficacy of our treatment formula. Trainees and many other medical practitioners will find this booklet very useful.

Professor AbdulWaheed Olajide Olatinwo

Chief Medical Director, UITH, Ilorin.

Director of IVF Centre

Coordinator's Note



It is incontrovertible that UITH ART unit has achieved domestication of safe and affordable Assisted Reproductive Technology techniques through her numerous achievements. This has indeed made the unit the first port of call on fertility related issues within the country and abroad.

As at the time of commencement of operations at UITH ART unit in 2012, ART technique was alien to all and sundry in our environment most especially as regards its realization and sustenance in a public funded institution like ours. Today the story is different.

Our unrelenting efforts at achieving such great success having attempted several fertility interventions over the years has enable us identify the most effective approach to solving infertility challenges in our environment. This has however necessitated the need to document such notable innovations tagged "UITH ART Fertility Treatment Protocols". The protocols comprise of all aspects of fertility interventions ranges from ovulation induction to In vitro fertilization/ Intracytoplasmic Sperm injection and endoscopic fertility surgeries.

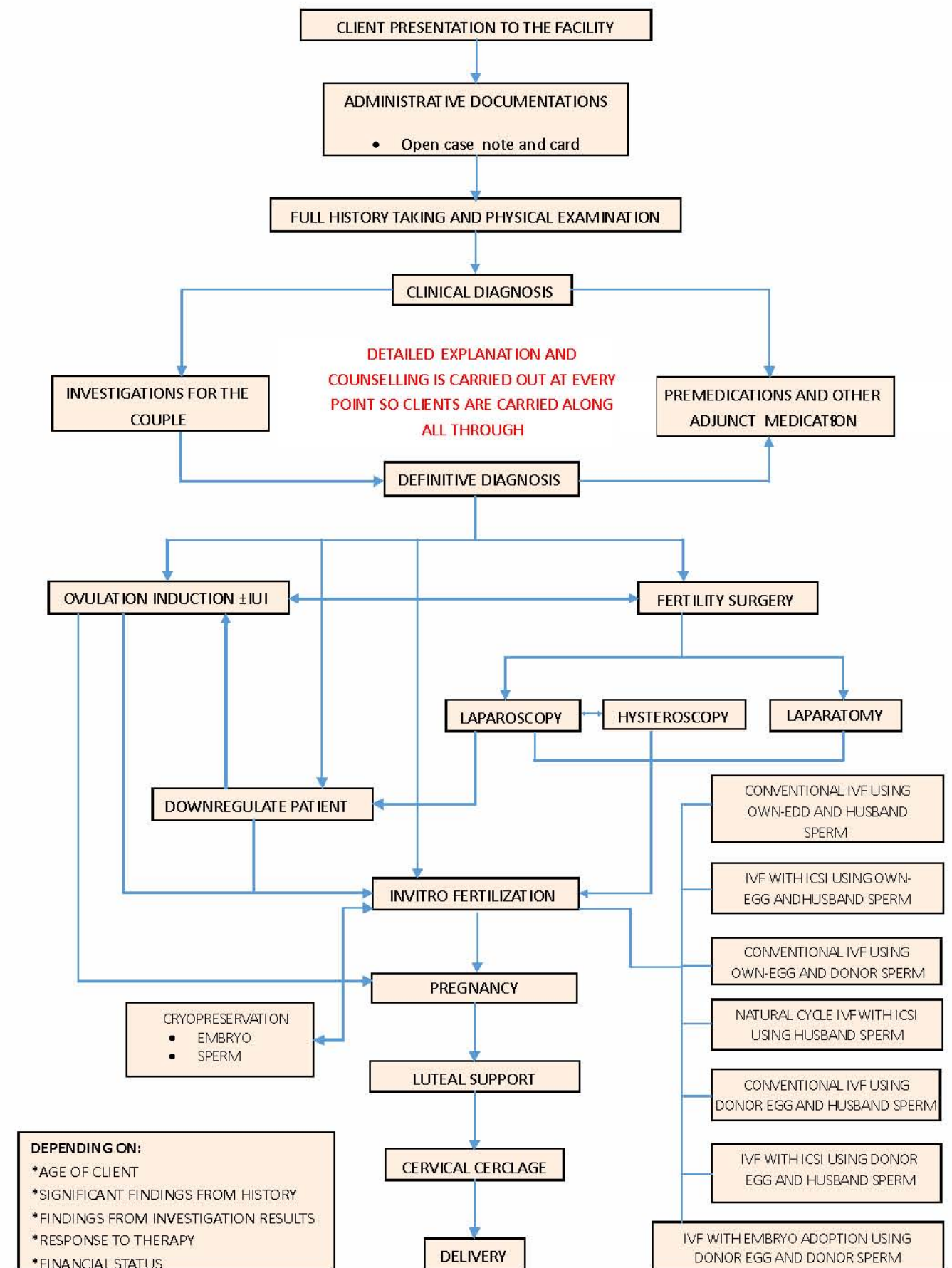
This will indeed serve as a reference tool for our practice, training of the intending reproductive medicine specialist and a formidable template for further research in the field of assisted conception.

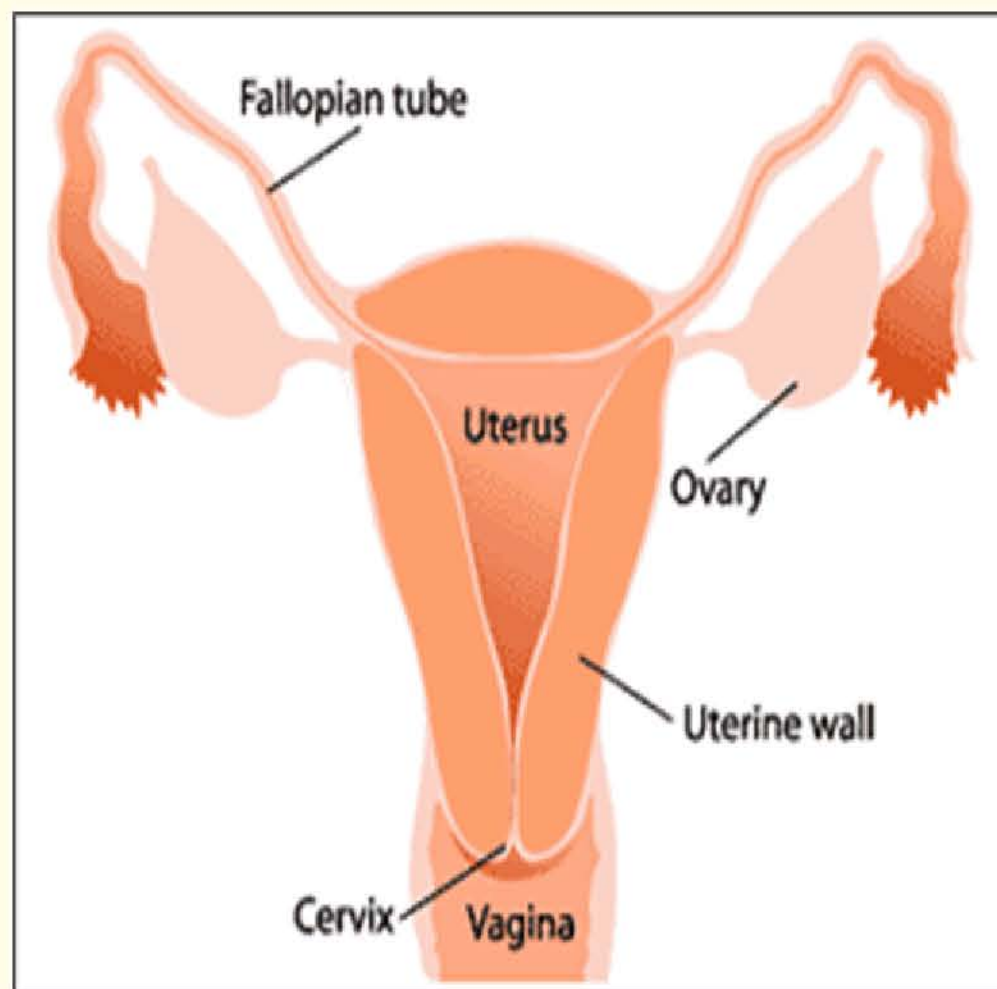
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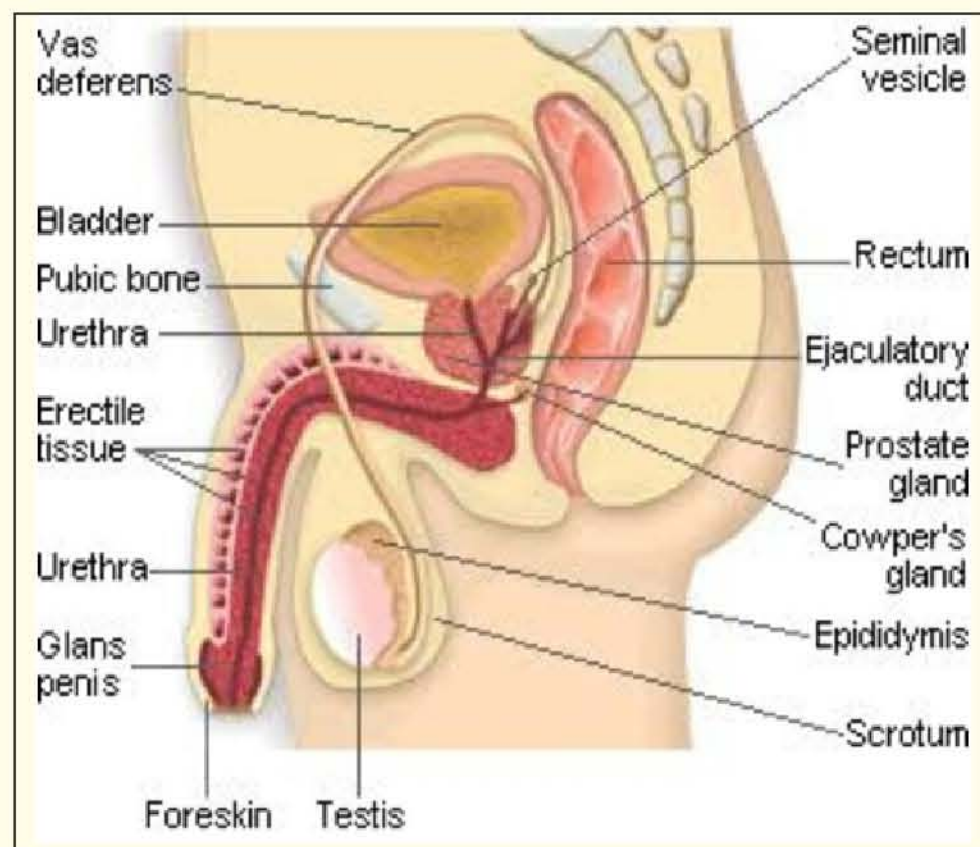
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Algorithm For Client Care At University Of Ilorin Teaching Hospital IVF Centre





THE FEMALE REPRODUCTIVE SYSTEM



THE MALE REPRODUCTIVE SYSTEM

Investigation For All Couples And Donors

A) FEMALE

1) Radiological investigations

- *Transvaginal Ultrasound Scan (TVS)*
* To check the cervix, uterus, and ovaries and identify pathologies present which could account for the infertility e.g. PCOS, uterine fibroid, etc.
- *To carry out Antral Follicular Count (AFC) to assess for ovarian reserve (i.e. in early follicular phase of the cycle)*
- *Hysterosalpingography (HSG)*
* To outline the cervix, uterus and fallopian tubes; picking up pathologies which could account for the infertility e.g. submucous uterine fibroid, intrauterine adhesions and tubal blockage

2) Biochemical

- *Hormone profile*
* Day 3: checking for FSH, LH, AMH, Prolactin, Estradiol and Testosterone (pointer towards ovarian reserve)
- * Day 21: checking for progesterone (pointer towards ovulatory status)
- * Random: checking AMH and prolactin (usually carried out for clients with menstrual irregularities or missed day 3)
- *Thyroid function test: checking TSH, T₃, T₄ (only carried out when clinical suspicions arise)*
- *Fasting/Random Blood Sugar/Oral Glucose Tolerance Test (OGTT) as indicated*

B) MALE

1) Semen sample

- *Seminal Fluid Analysis + MCS: checking volume, liquefaction time, sperm count/concentration, motility, morphology, viability and MCS (where significant WBCs are present)*
- *Semen Fructose Test: in cases of azoospermia, to rule out obstruction at the ejaculatory duct.*
- *Post ejaculatory urine microscopy: in cases of azoospermia, to rule out retrograde ejaculation.*

2) Imaging studies: In cases of oligospermia and azoospermia

- *Scrotal Ultrasound Scan + Doppler*
 - * To check for varicocoele
 - * To assess the epididymis, testicular size, architecture and vascularity
- *Transrectal Ultrasound Scan*
 - * To check the seminal vesicles and the prostate gland
 - * To assess for patency/obstruction of the ejaculatory duct

3) Hormone profile: in cases of azoospermia, to assess FSH, LH, Prolactin, Estradiol and Testosterone

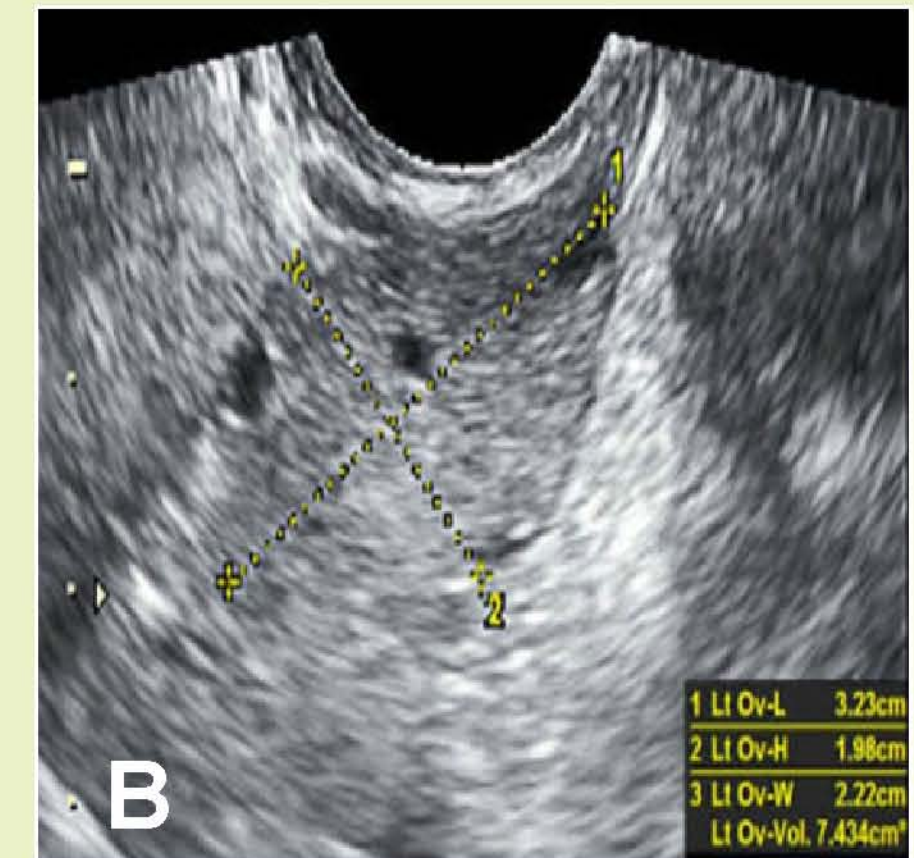
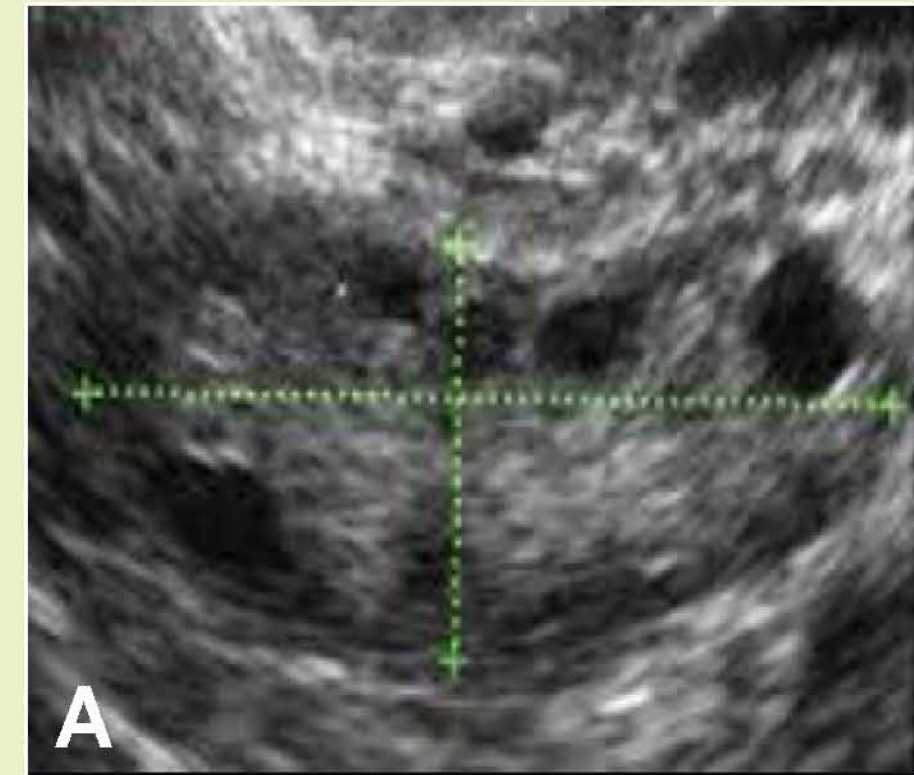
4) Testicular biopsy: in cases of azoospermia where indicated

C) COUPLE

- *Blood group*
- *Genotype*
- *Retroviral screen*
- *Hepatitis screen (HbSAg+Anti-HCV)*
- *Syphilis screen (VDRL)*
- *High vaginal swab/ Endocervical swab for chlamydia screen*

D) DONOR

- *Hormone profile: day 3 (FSH, LH, AMH)*
- *Blood group*
- *Genotype*
- *Retroviral screen*
- *Hepatitis screen (HbSAg+Anti-HCV)*
- *Syphilis screen (VDRL)*
- *High vaginal swab/ Endocervical swab for chlamydia screen*

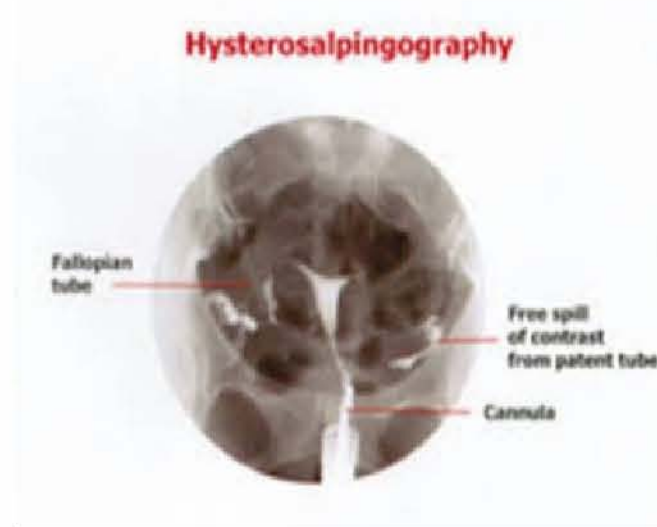


TRANSVAGINAL ULTRASOUND SCAN OF THE OVARY SHOWING THE ANTRAL FOLLICULAR COUNT (AFC)

- (A) Shows an AFC of 6, which indicates a good ovarian reserve
- (B) Shows as AFC of #, which a poor ovarian reserve



Transvaginal ultrasound scan showing the uterus



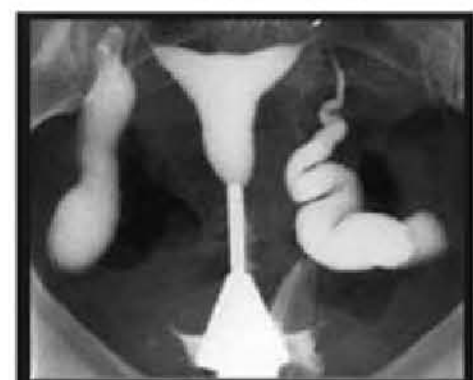
A Normal Hysterosalpingogram



NORMAL HSG

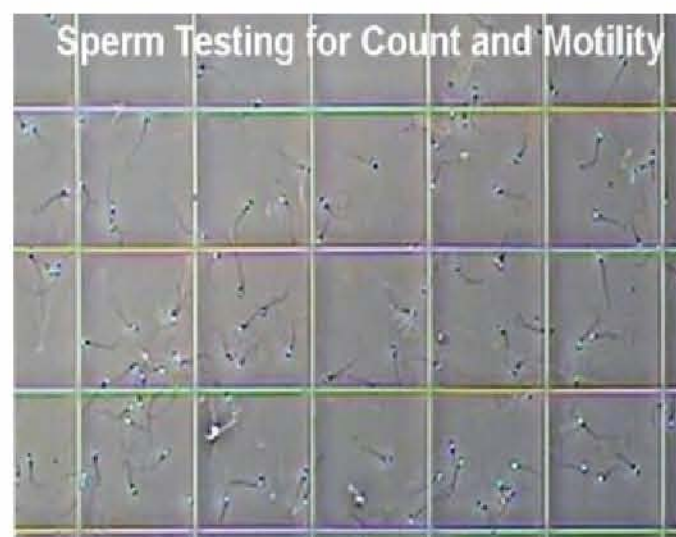


BLOCKED TUBES

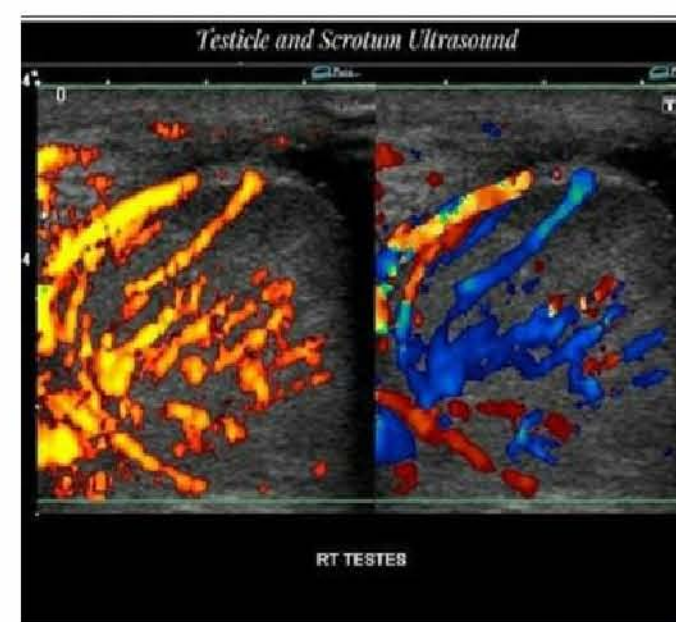


HYDROSALPINX

Hysterosalpingogram showing different outcomes



Seminal Fluid Analysis with a counting chamber



Scrotal Ultrasound Scan with Doppler studies

Premedications Used For Couples For Invitro Fertilization

A) FEMALE

1) All clients to be on:

- Tab Prenatal (contains folic acid, iron, etc.) 1daily until delivery
- Tab M2-Tone (herbal supplement) 1 BD until Pregnancy test is positive
- Tab Enart (contain Vitamin E) 400mg daily until Pregnancy test is positive

2) Clients at risk of poor ovarian reserve (E.g. client >35yr, PCOS, Endometriosis)

- Tab DHEA 25mg or 50mg daily until Pregnancy test is positive
- In addition to medications in 1 above

3) Clients with Polycystic Ovarian Syndrome

- Tab Hyponidd (herbal supplement with inositol) 2BD until Pregnancy test is positive
- In addition to 1 and 2 above

4) Clients with hyperprolactinaemia

- Tab cabergoline 0.5mg weekly or twice weekly until serum prolactin levels normalizes

B) MALE

1) All clients to be on

- Tab Enart (contain Vitamin E) 400mg daily until Pregnancy test is positive for their wife or until procedure is carried out

2) Clients with oligospermic SFA

- Tab Addyzoa 2 BD or TDS until SFA parameter normalizes or day of oocyte retrieval for insemination



Pictures of some of the premedications used in UIITH IVF Centre (A) Hyponidd and DHEA for clients with PCOS and those at risk of poor ovarian reserve respectively (B) Addyzoa and Cabergoline for clients with SFA anomaly and hyperprolactinaemia respectively

Ovulation Induction

INDICATIONS

- Anovulation/oligo-ovulation
- Polycystic Ovarian Syndrome (PCOS)
- Unexplained infertility
- Post Laparoscopic Ovarian Drilling (LOD) where indicated

PRE-REQUISITE: Before carrying out ovulation induction

- Tubal patency must have been confirmed either by Hysterosalpingography (HSG) or Laparoscopic dye-test
- Seminal Fluid Assay (SFA) parameters must have been judged to be normal, or near normal (good enough to support Intrauterine Insemination; as the need might arise)
- All other secondary causes of infertility should have either been ruled out, or treated properly.

GOAL: To get the client to recruit a dominant follicle, for which she is triggered to ovulate and the carry out timed intercourse or Intrauterine Insemination (IUI)

MEDICATIONS AND THEIR USES

1a) CLOMIPHENE CITRATE (CC): A selective oestrogen receptor modulator (SERM) which creates a pseudo-hypoestrogenic state in the hypothalamus, resulting in increased GnRH secretion and thus increased FSH/LH production to stimulate the ovaries to produce follicles. It also has an antioestrogenic effect on the cervical mucus and the endometrium, resulting in increased thickness of cervical mucus and thinning of the endometrium; thus, there is a resultant increased ovulation rate, but a low pregnancy rate. CC is the first line drug of choice for ovulation induction in PCOS clients.

- **Dosage:** CC is given in incremental doses, starting with 50mg, to a maximum of 150mg for 5days per cycle, from day 2,3,4 or 5 of the cycle (i.e. 50mg for 5days in first cycle, the 100mg for 5days in second cycle, the 150mg for 5days in subsequent cycles)
 - *CC-Resistance: when a client fails to ovulate after being on CC for 3cycles
 - *CC-Failure: when a client does not get pregnant after taking CC for 6 cycles
- **Japanese Protocol:** This protocol, as used in low cost IVF, suggests that CC should be continued beyond the 5th day in the course of the stimulation, until trigger is given; taking advantage of the antioestrogenic effect of CC to prevent premature LH surge in the course of the stimulation.

1b) LETROZOLE (LTZ): An Aromatase Inhibitor which blocks the synthesis of oestrogen by inhibiting the action of the enzyme aromatase, thus suppressing the oestrogenic inhibition of the Hypothalamo-Pituitary-Ovarian axis resulting in increased secretion of endogenous

gonadotropin secretion, without depleting oestrogenic receptors; thus cervical mucus and endometrial lining are unaffected, resulting in high ovulation rate and high pregnancy rate.

- **Dosage:** Letrozole is given at incremental doses of 2.5mg-7.5mg (usually 5mg) daily for 5 days starting from day 2, 3, or 4.

2a) COMBINATION OF CC/LETROZOLE WITH GONADOTROPINS (rFSH+ highly purified urinary FSH): This is usually adopted when there is evidence of follicular recruitment after taking CC/Letrozole, however, follicular growth and maturation were observed to be limited. The gonadotropins are administered on day 6, 9 and 12 of the same cycle which CC/Letrozole was used, and using either the step-up or step down regimen.

2b) GONADOTROPIN ALONE (rFSH+ highly purified urinary FSH): this is adopted in cases where follicular recruitment, growth or maturation are still not encouraging. The gonadotropins are administered on day 3, 6, 9 and 12.

ADJUNCT MEDICATION:

3a) METFORMIN: A biguanide which acts as an insulin sensitizer. It is used in PCOS patients as the pathogenesis of PCOS has been linked to insulin resistance. It also serves to regularise the hormonal milieu of PCOS clients, thus could even help them achieve spontaneous ovulation.

- **Dosage:** metformin is given at incremental doses of 500mg daily for a week, to 500mg BD for a week, to the targeted dose of 500mg TDS which should be maintained (depending on the tolerance of drug by the client)

3b) DHEA and HYPONIDD: These are herbal supplements that have been found to be helpful in improving the ovarian reserve as well as response to stimulation, especially in PCOS clients.

MONITORING

- After ovulation induction medications have been commenced, a TVS is performed on day 9 or 10 to assess for evidence of follicular recruitment and growth. Depending on the findings from this scan

- * Where follicular recruitment or growth is assessed to be poor, the cycle is cancelled, and subsequent cycle stimulated using either an increased dose of the same drug, another class of drug or a combination of drugs.
- * Where follicular recruitment and growth are assessed to be adequate, the TVS is then done serially to monitor the growth of the follicles (i.e. TVS is repeated on day 12, then 14 or 15 as the case may be), and decide on how to progress when follicular maturation is attained (i.e. when follicles attain 18mm-20mm size).

DECISION MAKING

The decision on how to progress depends on the number of matured follicles present

- Where 1-2 matured follicles (18mm-20mm size) present
*Administer rHCG 250µg and counsel client for timed sexual intercourse with her spouse
- Where 3-4 matured follicles (18mm-20mm size) present
*Counsel client for IUI
*Administer rHCG 250µg and carry out IUI after 36.5 hours of administering HCG
- Where >4 matured follicles (18mm-20mm size) present
*For fear of developing OHSS
-Withhold HCG injection and abandon cycle
-Counsel client to abstain from intercourse

*Counsel client for IVF and convert cycle to IVF
-Administer rHCG 250µg and carry out oocyte retrieval after 35.5 hours, then do embryo transfer on day 3 or 5. Alternatively, embryos could be cryopreserved, and transferred on a later date.



A Packet of Clomiphene Citrate

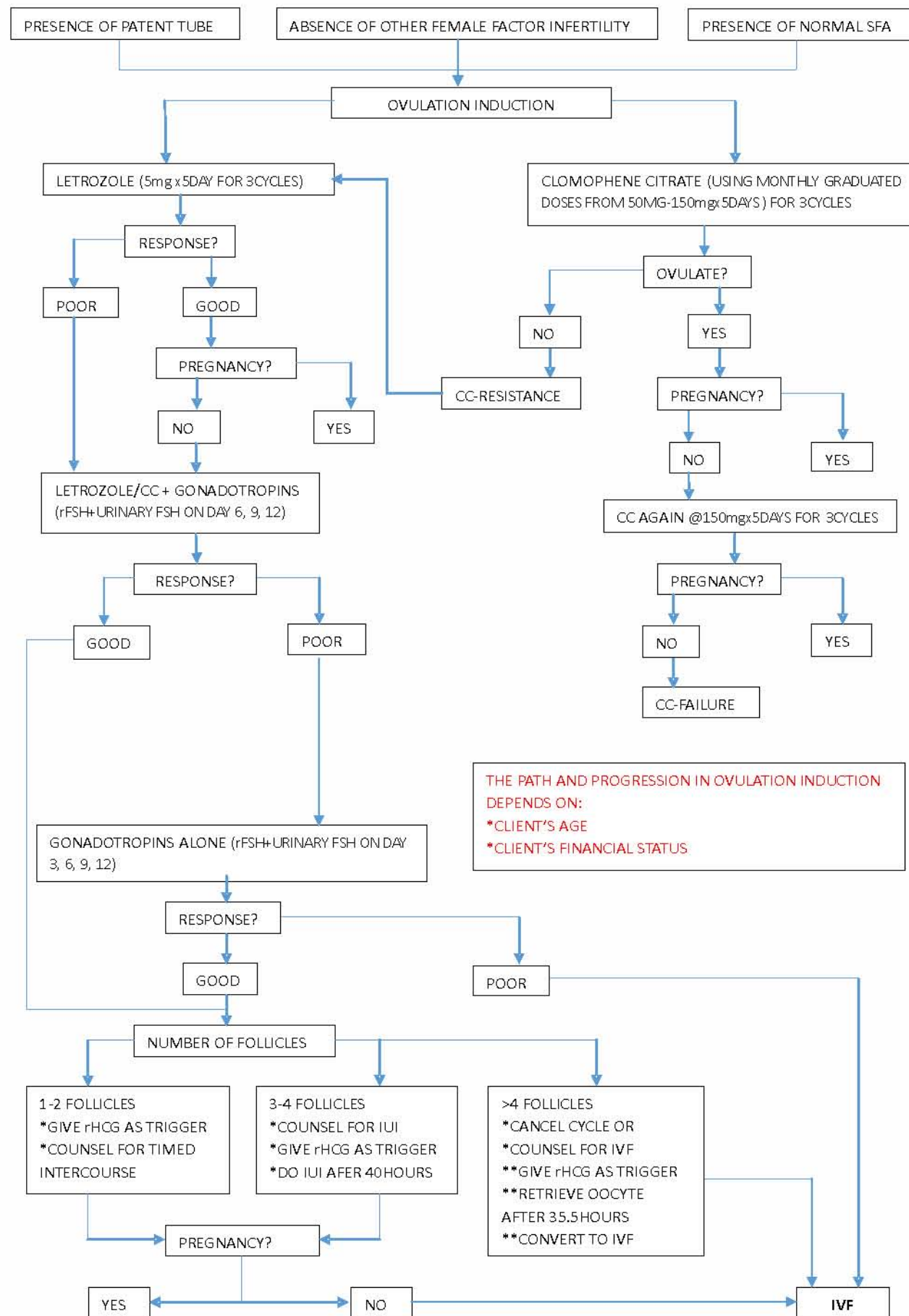


A Packet of Metformin

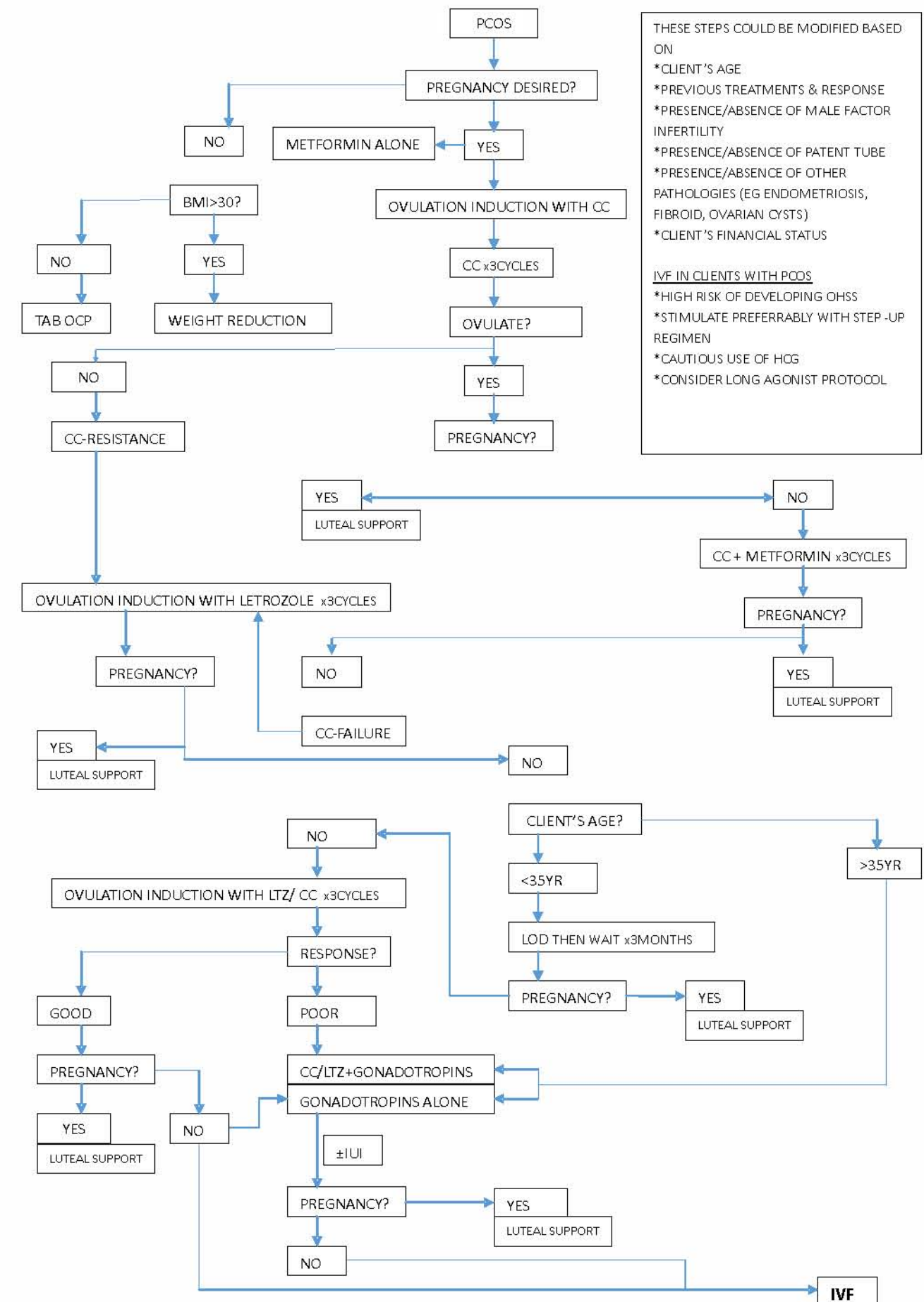


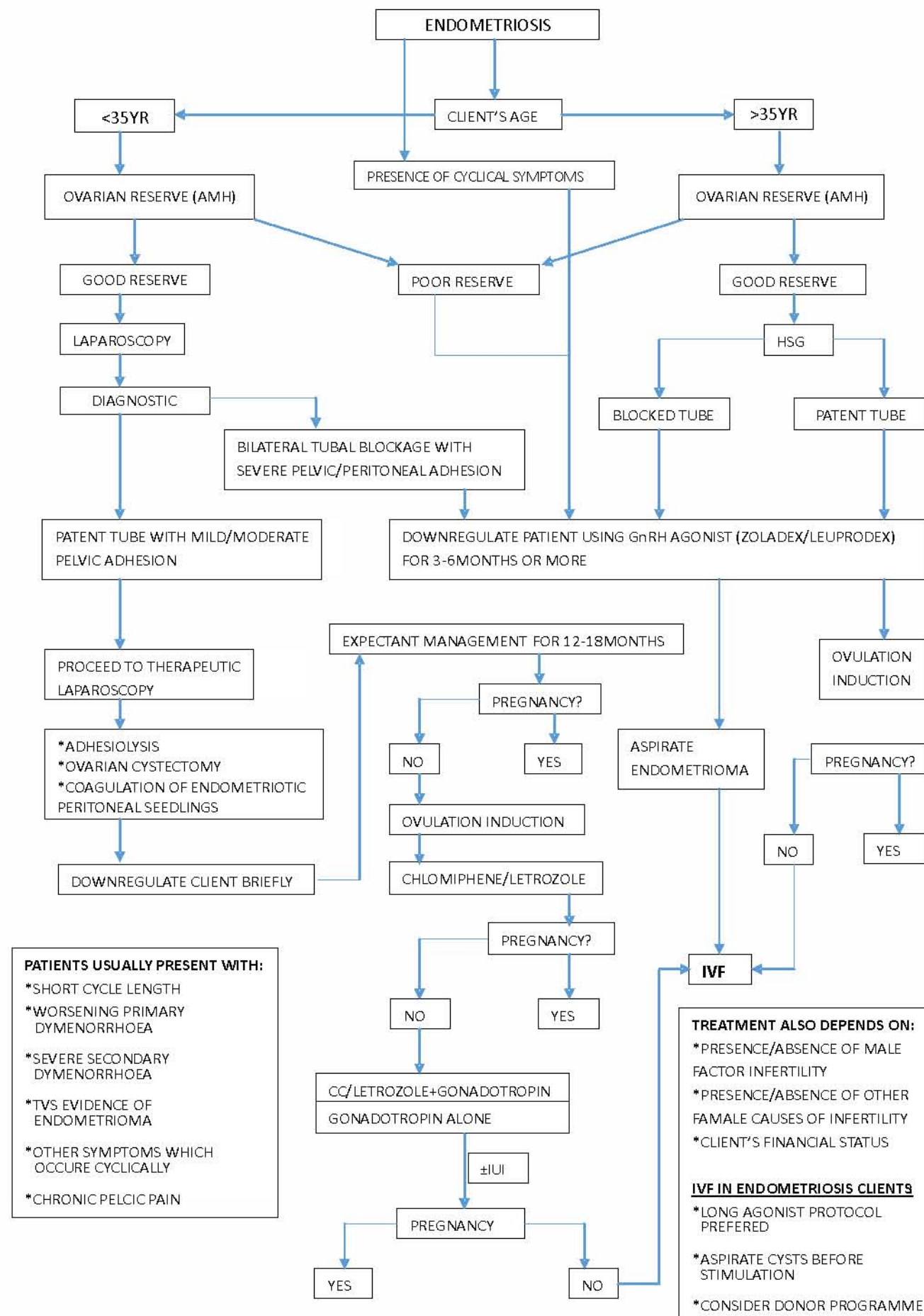
A Packet of Letrozole

Algorithm For Ovulation Induction



Algorithm For Management Of PCOS





This process depends on the type of IVF to be embarked upon by the clients (i.e. whether Own-egg IVF or Donor IVF).

Clients using own-egg are batched along with the donors so as to make them all menstruate at about the same time.

A client on DHEA or Hyponidd should have being on it for at least 6 weeks before being recruited to join a batch.

Recipients are synchronized to follow the menstrual pattern of their donors, in anticipation for embryo transfer subsequently.

Medications used for batching include:

- *Tab Combined Oral Contraceptive Pills (COCP): contains combination of Oestradiol and Progesterone
- *Tab Progynova: contains Oestradiol and comes as 2mg tablet
- *Tab Primolut-N: contains Progesterone and comes as 10mg tablet
- *Zoladex/Leuprodex: Zoladex contains Goserelin (a long acting GnRH agonist) comes as 3.6mg or 10.8mg while Leuprodex contains Leuprolide acetate and comes as 3.75mg SC injection

A) Menstrual Cycle Synchronization for Batching

All those in this category (own-egg clients and donors) are to be on Tabs COCP 1 daily, to be taken at the same time of the day, skipping the placebo tablets in each sachet.

*For a minimum of 21 days (i.e. clients joining the batch late must get the COCP for a minimum of 21 days while others can be on it for more than that before withdrawal is done)

*Withdrawal/ discontinuation of the COCP for all those taking it is done at the same time (i.e. they all stop taking it on the same day) following which the onset of withdrawal bleeding is awaited.

Following onset of withdrawal bleeding, Controlled Ovarian Hyperstimulation (COH) is commenced on Day 2, 3, or 4 after carrying out Pre-Cervical Assessment for the own-egg clients (excluding donors).

B Recipient Synchronization

Recipient synchronization is done based on the category of the recipient (cycling/premenopausal recipient OR Non-cycling/postmenopausal recipient)

CYCLING/PREMENOPAUSAL RECIPIENTS	NON- CYCLING/POSTMENOPAUSAL RECIPIENTS
Zoladex/Leuprodex 3.6mg/3.75mg is given SC, after the menses of the cycle preceeding the cycle for the IVF - The zoladex can be given anytime in the preceeding cycle, but preferable on day 21 of the preceeding cycle Following the onset of her menses in the IVF cycle, she commences Tab Progynova 2mg or 4mg BD or TDS to help build up her endometrium to about 7mm before the day of embryo transfer - The dose of progynova depends on her response, and the presence of other comorbidities like hypertension Progynova could also be commenced at any time following administration of zoladex (without waiting for her menses to start first) - If she menstruates while on progynova (i.e. during IVF cycle), she comes in for pre-cervical assessment on day 2,3, or 4 of her menses and continues with the progynova - If she does not menstruate, she comes in on day 2,3, or 4 of the donor's menses for pre-cervical assessment and possible endometrial curettage Following pre-cervical assessment, the dose of progynova is modified i.e. stepped up or stepped down (usually step -up for clients that had curettage done) as required - Client needs to be on progynova for a minimum of 10 days before embryo transfer to help build up the endometrium to receive the embryo.	These clients would have stopped menstruating, thus their uterus would have undergone some atrophy To build back the capacity of the uterus, client is placed on - Tab Progynova 2mg or 4mg BD or TDS for 35days then Tab Primolut -N 10mg TDS for 7days, starting from day 29 of the progynova - After completing the 35days of medication, client is to wait for her menses; after which she repeats another cycle of progynova/primolutun-N - Client is to have minimum of 3cycles (even up to 6cycles, depending on the achieved uterine size) before she can be recruited to join an IVF batch To prepare client for embryo transfer - Following commencement of donors on tab COCP, client is instructed to withhold/discontinue use of primolut-N, and continue on only progynova - Withholding of primolut -N could also commence from when COCP is withdrawn for the donors Following onset of withdrawal bleeding in the donors, the client is invited for pre-cervical assessment and possible endometrial curettage on day 2,3, or 4 of the donor's menses Following pre-cervical assessment, the dose of progynova is modified i.e. stepped up or stepped down (usually step -up for clients that had curettage done) as required - Client needs to be on progynova for a minimum of 10 days before embryo transfer to help build up the endometrium to receive the embryo.



Some of the medications used for batching of clients and menstrual synchronization (A) Leuprodex (B) Estradiol (C) Combined Oral Contraceptive Pills

This is done to assess the cervix, uterus and ovaries to check for, and possibly address factors present that could impact negatively on COH and most especially embryo transfer. This procedure is carried out on day 2, 3, or 4 of menses for all clients (excluding donors) undergoing that batch of IVF.

- **Aim:** The aim of doing pre-cervical assessment/ dummy transfer is to ensure an easy and smooth embryo transfer when the time comes.

Procedure

- 1) Client lies supine in lithotomy position (legs suspended with stirrups), on a clean disposable underlay after emptying her bladder
- 2) A TVS is performed to check that the ovaries are quiescence, and note the endometrial thickness
 - *All cysts present in the ovaries (endometrioma, persistent follicular cysts, etc.) should be aspirated under TVS guidance
- 3) Sterile Cusco speculum is then inserted into the vagina gently to expose the cervix
 - *Note the speculum size with which the cervix was exposed easily with minimal manipulations
 - *Note the position of the cervix
 - *Note the length of the cervix
- 4) Gently pass a sterile long curved uterine sound through the external os of the cervix into the uterine cavity
 - *Note the entrance of the cervix
 - *Note the dilatation of the cervix
 - *Note the orientation of the uterus
 - *Note the depth of the uterus
 - *Serial dilatation of the cervix is done for clients with stenosed cervix
- 5) Using a sterile outer sheath of a transfer catheter, assess the uterine cavity through the external os with as little manipulation as possible, using all the information derived
 - *This would be repeated on the day of embryo transfer
- 6) Recipients would then have endometrial curettage done where indicted

- 7) Client is then cleaned up
- 8) Adequate documentation of all the above findings is then carried out as this documentation will be reviewed on the day of embryo transfer as follows

- *Speculum size
- *Cervical position, length, entrance and dilatation
- *Uterine orientation and depth

AFTER COMPLETING PRE-CERVICAL ASSESSMENT

- Clients using own-egg are commenced on the medications for COH (gonadotropins)
- Recipients would have the dose of progynova modified as appropriate
- Donors who were excluded from pre-cervical assessment are commenced on medications for COH from day 2, 3, or 4 of their menses
- TVS is done on day 6/7 of stimulation
 - *For all those on stimulation (own-egg clients and donors) to assess for follicular recruitment
 - *For all recipients to assess for endometrial thickness, with adjustment of progynova dose where indicated.

There are several medications under different groups which are used to stimulate the ovaries to produce several follicles, while using different protocols

These groups of medication include

- 1) Downregulatory medication
 - GnRH Agonist e.g. Suprecur (Buserelin), a short acting GnRH agonist comes as 1mg in 1ml and is given as a SC injection
- 2) Premature LH surge Inhibitor
 - GnRH Antagonist e.g. Cetrotide (Cetrorelix) comes as 0.25mg and is given as a SC injection
- 3) Recombinant FSH: they come as 75IU, 150IU preparations and given as SC injection
 - Gonal-F
 - Follitrope
 - Gonadotropin
- 4) Highly purified urinary FSH: This contains some LH activities, and is used for LH supplementation
 - *To prevent follicular atresia in early follicular phase
 - *To promote follicular growth, maturation and steroidogenesis in the late follicular phase
 - **Folliculin:** comes as 75IU preparation, and is given as IM/SC injection
 - **Disclair:** comes as 75IU, and 150IU preparations, given as IM/SC injection
- 5) Recombinant HCG
 - **Ovitrelle:** comes as 250 microgram (equivalent to 6000IU) and is given as SC injection

AGONIST (LONG AND SHORT) PROTOCOL	ANTAGONIST PROTOCOL
Buserelin is given to the client daily from day 21 of the preceding cycle, until the day of giving final maturation trigger 0.5mg is commenced from day 21 until the onset of her menses (for short agonist protocol, 0.5mg is commenced from the day her menses starts, for 3 days) - With onset of menses, buserelin dose is then halved to 0.25mg and is given daily until day of trigger (for short agonist protocol, buserelin dose is halved from day 4) Recombinant FSH and highly purified FSH are then commenced on day 2, 3, or 4 of menses, given daily at the same time, using either the step-up or step down dose regimen, until the day of trigger. - Usually, 150IU rFSH + 75IU highly purified FSH is used to commence, then the rFSH is later reduced to 75IU based on response TVS is done on day 5, 6, or 7 of stimulation to check for follicular recruitment. - TVS is then done serially to monitor follicular growth and endometrial thickness - When ≥ 2 follicles are observed to measure ≥ 18mm, final maturation trigger is indicated Final maturation trigger is achieved by giving 250µg (equivalent to 6000IU) of rHCG - On the day of giving rHCG, buserelin, rFSH and highly purified FSH are all not given (only rHCG is given on that day) Oocyte retrieval is then carried out 35.5 hours after administering the trigger Agonist protocol is associated with a high incidence of Ovarian Hyperstimulation Syndrome (OHSS) It is the protocol of choice for clients with Endometriosis and PCOS	Recombinant FSH and highly purified FSH are then commenced on day 2, 3, or 4 of menses, given daily at the same time, using either the step-up or step down dose regimen, until the day of trigger. - Usually, 150IU rFSH + 75IU highly purified FSH is used to commence, then the rFSH is later reduced to 75IU based on response TVS is done on day 5, 6, or 7 of stimulation to - Check for follicular recruitment - Measure the follicles (if up to 12-14mm) - Measure endometrial thickness TVS is then done serially until follicles are noted to be ≥ 18mm when final maturation trigger is indicated Cetrotide 0.25mg is commenced from - Day 6 of stimulation OR - When follicles have grown to 12-14mm OR - When LH becomes detectable in urine (using predict strip to test the client's urine daily) Cetrotide is given daily, along with rFSH and highly purified FSH, until the day of trigger Final maturation trigger is achieved by giving Buserelin 0.25mg + HCG 83µg (equivalent to 2000IU) - On the day of giving trigger, rFSH, highly purified FSH and cetrotide are all not given (only the medications for trigger are given) Oocyte retrieval is then carried out 35.5 hours after administering the trigger Antagonist protocol is associated with less incidence of OHSS.

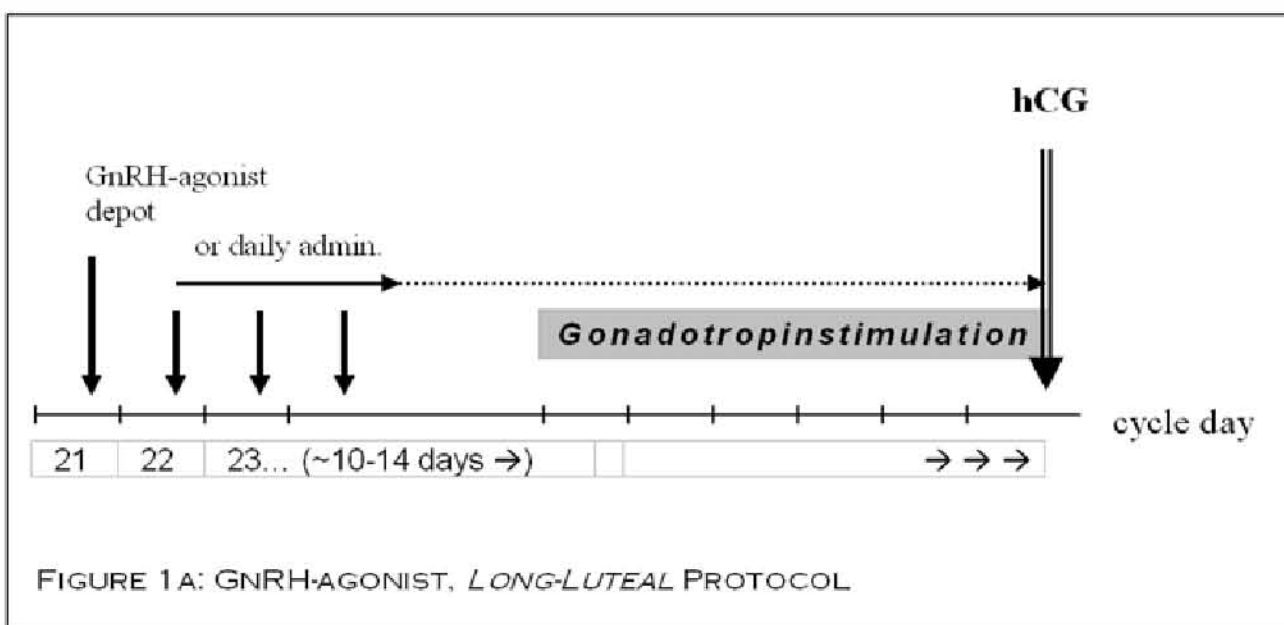


FIGURE 1A: GNRH-AGONIST, LONG-LUTEAL PROTOCOL

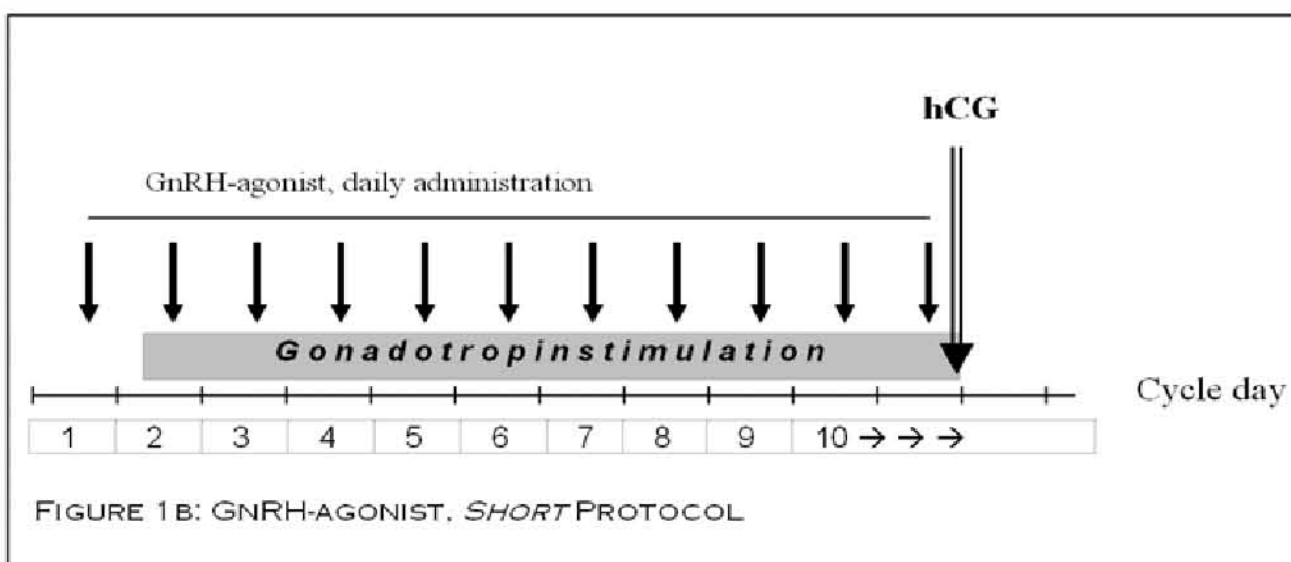


FIGURE 1B: GNRH-AGONIST, SHORT PROTOCOL

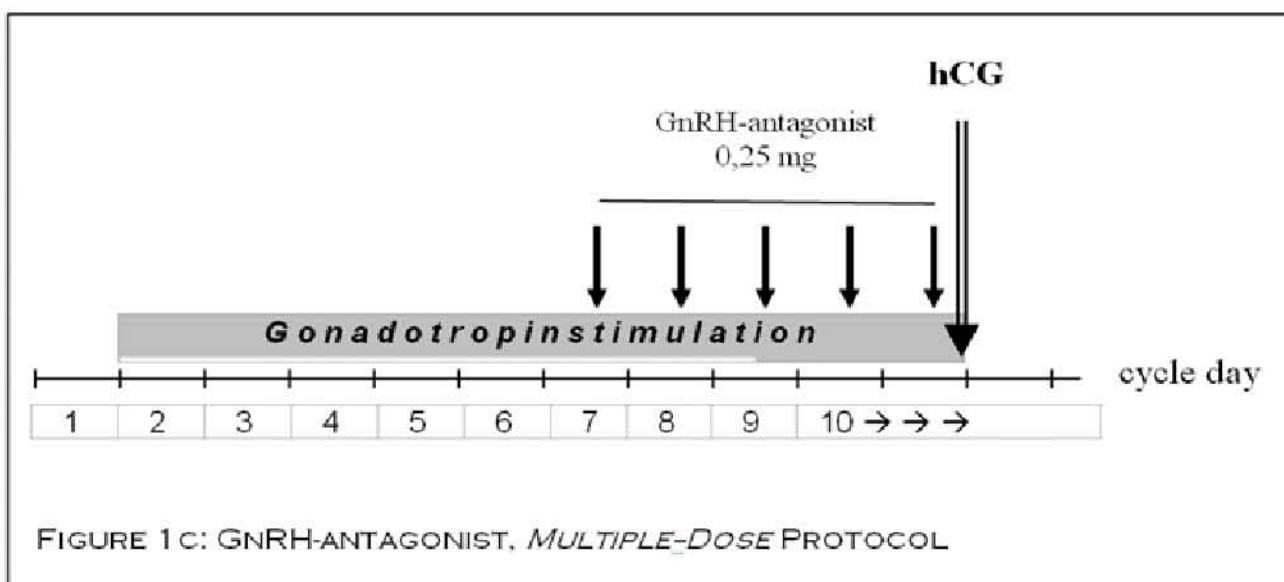


FIGURE 1C: GNRH-ANTAGONIST, MULTIPLE-DOSE PROTOCOL



Recombinant FSH preparations (A) Gonal-F (B) Gonadopin (C) Follitrope



Highly Purified Urinary FSH preparations used for LH supplementation (A) Foliculin (B) Diclair



Other Medications used in the course of stimulation (A) Cetrotide (B) Ovitrelle (C) Suprecur



Transvaginal Ultrasound Scan showing good follicular recruitment while on stimulation



Transvaginal Ultrasound Scan showing numerous matured follicles set to be triggered



Transvaginal Ultrasound Scan showing matured leutinized follicles about to be aspirated

Oocyte Retrieval

This is carried out in the theatre, using strict aseptic technique, under transvaginal ultrasound guidance via transvaginal route (methylated spirit, air condition, perfumes, telephones are not allowed into the retrieval theatre)

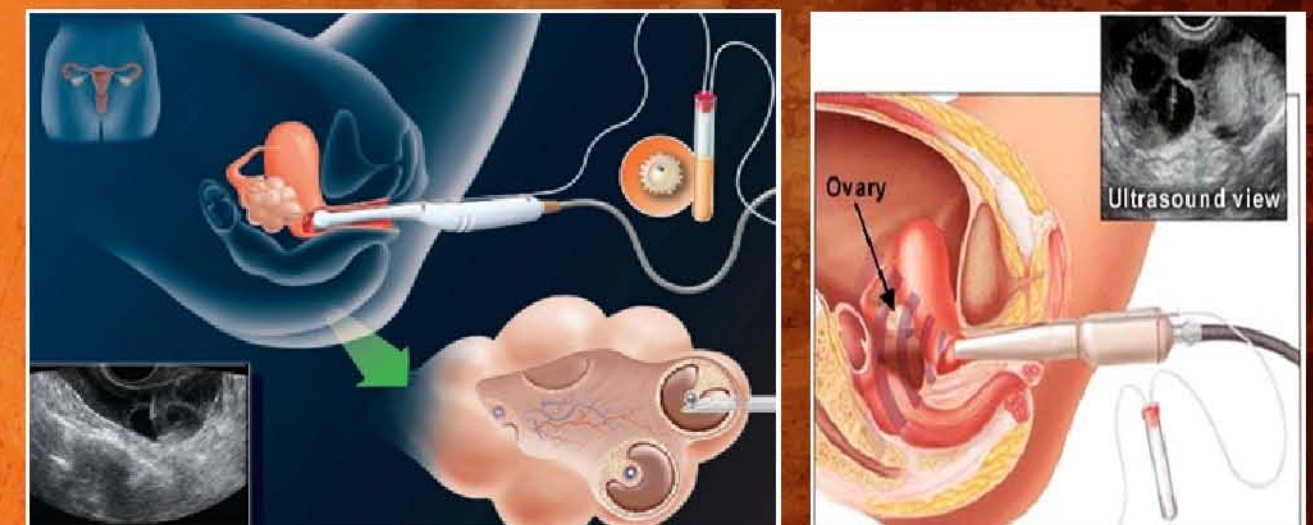
PROCEDURE

- 1) Client is counselled to not take breakfast on the morning of retrieval (preferably, client could also skip dinner on the night preceeding retrieval)
- 2) Client is asked to empty her bladder and change from home attire into sterile gown and head cover
- 3) Intravenous cannula is inserted preferably on the arm away from where the ultrasound scan (USS) machine is placed in the theatre
- 4) Client then goes into the theatre, then assumes a supine lithotomy position (legs suspended using Lloyd Davis stirrup)
- 5) Sterile test tubes are opened and placed in the warming chamber (heating block) to pre-warm the test tubes before the procedure
- 6) Anaesthetic medications are then administered
 - * IV Diazepam 10mg diluted up to 4ml is given slowly
 - * IV Atropine 1mg diluted up to 5ml is given slowly
 - * IM Ketamine 1ml is given into the deltoid muscle (cleaning with sterile gauze soaked in normal saline)
 - * IV Ketamine 1ml/2ml (depending on client's body mass) diluted up to 5ml is then given slowly
 - * IV metoclopramide 10mg stat may be given where indicated (e.g. where client must have had breakfast)
 - * IVF Normal Saline 500ml/1L is then commenced to run slowly while the procedure commences
 - * Client is then positioned with the head to the left while she is fully asleep
 - * 1ml/2ml of ketamine is diluted up to 5ml and is used as a top up dose depending on client's response, given 1ml at a time

- 7) With the needle guide placed over the TVS probe, and gel placed ONLY inside the sterile condom used to cover the probe, a quick TVS is performed to assess for signs of luteinisation (hazy appearance of the follicles, with increased thickness of the follicular walls), indicative of the need to hurry up with the retrieval otherwise the oocytes would be lost.
 - * Using the aspiration needle, pierce the condom, into the needle guide and gently advance until the needle is visible at the top of the scan field in the screen
 - * Gently pierce the follicles, one at a time, starting with the follicles closest to the needle and aspirate the follicular content (fluid) into the pre-warmed sterile test tubes, which should remain in the heating block (pre-set at 37°C) until transfer to the laboratory is done.
 - * Aspiration could be done either Manually (using 20ml syringe) or Mechanically using the microsuction pump with pressure pre-set at 110mmHg (pre-set pressure should always be less than 120mmHg)
 - * The light in the theatre should be dimmed throughout aspiration, and should remain so until all follicular fluid has been sent to the laboratory for oocyte identification and pick up (oocyte screening)
 - * Complete aspiration of one ovary is done, before switching to the other ovary
 - * After aspirating both ovaries, the bladder is emptied using Foley's catheter, then 800mg of cyclogest pessaries is inserted into the posterior fornix of the vaginal (for own-egg clients, not for donors)
- 8) Client is then gently transferred to the recovery room where client sleeps until she fully regains consciousness, while IV antibiotics are administered
 - * IV Ceftriaxone 1g stat for own-egg clients
 - * IV Ciprofloxacin 200mg stat for donor (ciprofloxacin in early pregnancy is not safe)
- 9) When client is fully conscious, and all dressed to go home, she is placed on Tab Ibuprofen 400mg BD/TDS for 3 days, Cyclogest Pessaries 800mg BD, along with oral antibiotics where indicated.



The UIITH IVF Team during an oocyte retrieval procedure



*Illustrations of the process of oocyte retrieval
(Note the presence of retrieval needle within the ovarian follicles)*

This involves a series of events that begins from approximately during batching, through to the day of oocyte retrieval, and ultimately culminating on the day of embryo transfer (day3 or day5)

All laboratory activities are carried out under strict asepsis, wearing sterile scrubs, face mask and gown, with dim light in a fragrance free environment at room temperature (air condition is off)

DURING BATCHING

PREPARATIONS FOR PROCEDURE/ GENERAL MAINTENANCE

1. Sterilization of incubator(s) once per month.
2. Calibration and quality control check of incubator's temperature and CO₂ level, hot block, work station and ICSI's heated stage.
3. Prepare all consumables needed:
 - Retrieval needle
 - Test tubes and falcon tubes
 - Plain dishes, centre well dish, Nunc 4 dish
 - Non-powdered gloves, syringes (1ml, 2ml and 5ml)
 - Denudation pipette
 - Transfer catheters
 - Oil
 - Media which includes
 - *Sperm wash media, gradient media (45% and 90%)
 - *Oocyte handling media
 - *Fertilization media
 - *Culture media which could be Sequential media OR Single step media

DAY OPU-1 (Day before retrieval)

- All materials and consumables required are checked properly
- The embryologist receives the Physician's Order containing
 - *Name of each client (own egg client, recipient and their donors)
 - *Estimated follicular count
 - *Purpose (conventional IVF, ICSI, or Cryopreservation)
- All tubes and dishes are labelled with date and name of the media to be dispensed.
- The laminar flow is switched on, light switched off and the incubators are switched on.
- All media and oil are prepared and incubated overnight.
- The air conditioner is switched on overnight.

DAY o (Day of oocyte retrieval)

A. OOCYTE SCREENING

1. On the stage warmer for oocyte screening, switch off the air condition, switch on the hepa filters and deem the light. Identify the patient in the procedure room and hand over the flush media to the physician.
2. Collect the follicular fluid and, then the fluid is poured into a dish on the warmed stage and search for the presence of cumulus-oocyte complex (which is retrieved) as fast as possible.
 - *Place the follicular fluid in a hot block to maintain the temperature at 37°C while it is yet to be screened
3. The retrieved cumulus-oocyte complex (COC) is washed briefly three times in the handling media and transfer to the fertilization media and wash briefly also thrice and transfer to a fresh fertilization media labelled with the patient's name. (not more than 10 COC per dish) and incubate for 2-4 hours for maturation.

B. SPERM PREPARATION

1. Make gradient media for sperm preparation: Add 1.5ml 90% into falcon tubes and slowly add 1.5ml 45% unto it. Place on tube rack at room temperature.
2. Add semen slowly unto the gradient mixture (not more than 3ml) and centrifuge at 1300 rpm for 20 minutes. Aspirate the supernatant with disposable pipette and add 5ml of sperm rinse media and centrifuge again at 1300 rpm for 10 minutes, aspirate the supernatant and place the tube containing the pellets in the incubator.

C. INSEMINATION

1. Add the prepared sperm to the washed oocytes with a micropipette. (150x10⁶ per ml).
2. Incubate for 16-18 hours.

D. MEDIA PREPARATION

1. Switch off the stage warmer, switch on the laminar flow and switch off the light.
2. Make 4 drops of cleavage media in the centre well dish and overlay with oil (3 or 4 dish per patient depending on the number of oocytes).

DAY OPU + 16-18 HOURS (FERTILIZATION CHECK)

- 1) At the 18th hour, the inseminated COC is stripped gently of its cumulus cells using a glass denudation pipette (140mm and 170mm). It is washed and transferred to a new dish containing culture media (cleavage media where sequential media is used OR global total which is a single-step media) and checked for signs of fertilization which should be.
 - Presence of 2 pronuclei (PN) and 2 polar bodies (PB)

- However, the presence of 1PN and 2PB, or No PN and 2PB could be indicative that the ideal findings could have been missed, though fertilization has occurred

*Thus such should be preserved and reassessed again for cleavage on day3

- The fertilized zygote could subsequently be graded using the Number and symmetry of the Nuclear bodies present in the PN (in terms of their arrangement) using the Z score or the Pattern grading.
- Recipient clients are commenced on cyclogest following confirmation of fertilization of oocytes from their donor

DAY 2

- Fertilized zygotes are left undisturbed in the incubator all through until day3
- Cleavage media is prepared and incubated overnight in anticipation of a possible transfer on day3

DAY 3 (Embryo Grading)

- The fertilized zygote is assessed on the ICSI machine stage OR workstation for evidence of cleavage to form Embryo, which is subsequently graded accordingly

NUMBER OF CELLS	CELL SYMMETRY AND SIZE	LEVEL OF FRAGMENTATION	GRADE
8	Symmetrical and equal = A	5-10% = A or 1	8AA or 8A1
7	Asymmetrical and not equal = B	10-25% = B or 2	7BB or 7B2
6		25-50% = C or 3 >50% = D or 4	

- Depending on the number of good quality embryos available, Embryo Transfer (on day3) OR Extended/Blastocyst Culture (to day5) is done.

- Where limited number of good embryos are available, Embryo Transfer is scheduled

*Embryo transfer is carried out using cleavage media which is prepared on day2, or at least 2 hours before the procedure is done.

- Where numerous good embryos are available, blastocyst culture is done
- *The embryos are transferred from the cleavage media to the extended media where sequential culture media is being used, and placed back into the incubator. However, where single-step culture media is used, the embryos are placed back into the incubator without switching media.

- Where numerous good embryos are available, and there is the requisite skill for

doing a Double Embryo Transfer; then the best of embryos available could be transferred on day3, while other embryos are replaced in the incubator and cultured further to day5 and then transfer is done again.

DAY 4

- Embryos are left in the incubators undisturbed, while transfer media is prepared for day5 blastocyst transfer (the transfer media can also be prepared 2 hours before the procedure on day5)

DAY 5 (Blastocyst Grading)

- The embryos are assessed for evidence of blastocyst formation, which will subsequently be graded

ZONA PELLUCIDA EXPANSION/PROGRESSION	INNER CELL MASS	TROPHOECTODERMAL CELLS	IDEAL
Thick ZP = Early blast = 4	Several cell & well compacted = A	Several very thin cells = A	6AA or 5AA
Thin ZP = Expanded blast = 5	Large cells & not well compacted = B	Large cells = B	
Hatching blast = 6	Not compacted = C	Very Large cells = C	

- Good quality blastocysts are then selected for subsequent transfer

Embryo Transfer (Laboratory Perspective)

- 1) Embryos/blastocysts to be transferred are selected and isolated for easy access and projected on a television screen to the couple where possible
- 2) When it is demanded for, the outer sheath of the transfer catheter is passed to the surgeon in theatre (where it is threaded into the external os) and then the instruction to load embryo/blastocyst is awaited
- 3) Upon instruction to load, embryos/blastocysts are taken out of the incubator and loaded into the soft inner sheath of the transfer catheter as follows
 - Flush the catheter with the transfer media using the 1ml syringe, leaving about 0.03ml left in the catheter, ensure that no air bubble is trapped in.
 - Take in a little air into the catheter
 - Take in the embryo/blastocyst with some media
 - Take a little air column again
 - take some media to seal the catheter tip
 - *Gloves are not worn when loading the embryos
 - *The amount of media used in the transfer should be limited so as to prevent occurrence of ectopic gestation
- 4) The loaded catheter is then passed to the surgeon carefully, with the syringe end presented to the surgeon first (who then threads it via the outer sheath into the endometrium, to deposit the embryos 20mm from the fundus)
- 5) After the transfer, the transfer catheter is passed to the embryologist by the surgeon (both the inner sheath with the outer sheath as a unit) for them to be examined for any retained embryo/blastocyst and this is carried out by
 - *Flush the catheter with some transfer media into a dish and examine the content of the dish for the presence of any retained embryo/blastocyst.



Illustration of Intracytoplasmic Sperm Injection (ICSI)



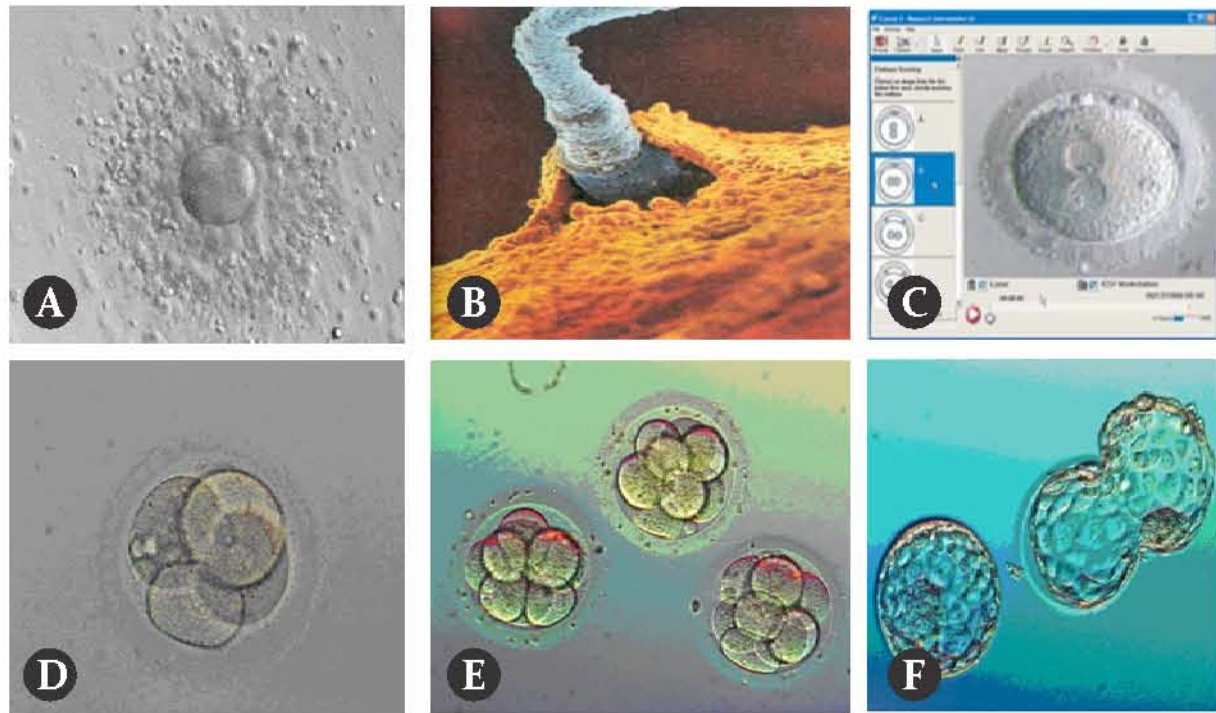
UIITH IVF Team during an oocyte screening procedure (oocyte identification and pick up)

This is an aseptic procedure carried out on either day3, day5 or on both days in dim environment at room temperature

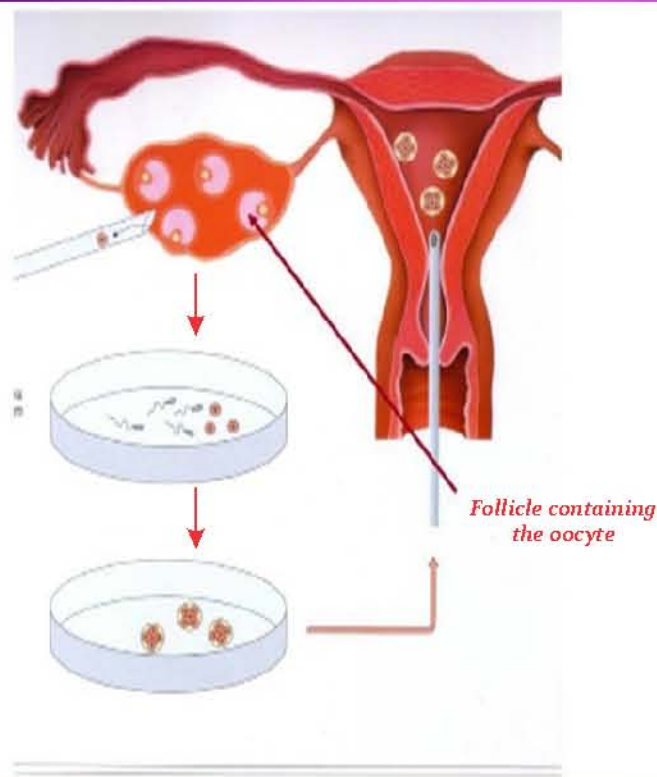
Clients would have been commenced on cyclogest (to switch their proliferative endometrium to secretory endometrium in anticipation of the embryo transfer) either on the day of oocyte retrieval (for own-egg clients) or when fertilization has been confirmed (for recipient clients).

A) Day3 or day5 transfer

- 1) Couple arrives and sit comfortably in the reception, while the client drinks about 1L of water and waits patiently until she feels pressed to urinate
 - She is then taken in to change into sterile gown and head cover, while her spouse puts on an overall and they both go into the theatre waiting area where the procedure will be explained to them, and the embryos/blastocysts to be transferred are projected for the couple to see on the television screen
 - The client then goes into the theatre while her spouse goes back to the reception to wait
- 2) In theatre, client assumes a supine lithotomy position, following which cleaning of the anterior abdominal wall, thigh and vagina is done using normal saline and then client is draped
 - Findings from the pre-cervical assessment is read out for the surgeon
 - Gel is placed on the suprapubic region and then a transabdominal USS probe (covered with sterile material) is placed on the gel to do a scan, identifying the uterus and endometrial lining on the scan
 - *If there is difficulty identifying the uterus, gently pass Foley's catheter to empty some urine from the bladder so as to get a better vision on the scan then remove the catheter
 - Appropriate Cusco speculum is passed to expose the cervix, following which the external os of the cervix is cleaned with gauze soaked with normal saline (the vagina could be irrigated before cleaning the cervix if desired)
 - Gently aspirate cervical mucus from the cervical canal using a sterile IUI catheter and syringe, then demand for the outer sheath of the transfer catheter from the laboratory



A: Cumulus-Oocyte Complex B: Spermatozoa penetrating an oocyte
C: Fertilized oocyte showing double pronuclei and polar bodies D: Zygote at 4cell stage E: Embryo at 8cell stage (day3) F: Blastocysts at day5 (expanded blastocyst and hatching blastocyst)



Illustrative summary of the entire IVF process from oocyte retrieval to semen insemination, embryo culture and ultimately embryo transfer

- The gauge on the outersheath is adjusted based on the uterine depth (from pre-cervical assessment), such that there would be about 2cm gap between the uterine fundus and the intended site where the embryos would be deposited.

*This gauge adjustment is noted in cases where a combined day 3 and day 5 transfer would be done

- The outersheath is then passed gently through the cervical canal, into the uterine cavity (where it could be visualised on the USS screen) then the embryologist is instructed to load the embryos/blastocysts in the inner sheath of the transfer catheter
- The loaded inner sheath is gently received from the embryologist with the syringe end and then gently threaded through the outer sheath into the uterine cavity (where the tip of the inner sheath would be visualized on the USS screen)
- The embryos/blastocysts are gently injected into the uterine cavity, and then both the inner sheath and outer sheath are removed together as a unit from the uterine cavity, cervix and vagina while making spiral motions so as to dislodge any embryo/blastocyst trapped to the tip of the catheter
- The removed catheter (inner and outer sheath as a unit) is then passed to the embryologist to check for any retained embryo/blastocyst

*If there is a retained embryo/blastocyst, the outer sheath is passed to the surgeon again and the whole transfer process is repeated

*If there is no retained embryo/blastocyst, a confirmatory scan to visualize the deposited embryo/blastocyst is done

- The speculum is carefully removed, and the urine emptied using Foleys catheter then 800mg of cyclogest is inserted into the posterior fornix of the vagina
- IM Gestone 100mg is given, then the client is gently transferred to the recovery room where she rests for about 15-30 minutes, then she changes to her home attire and is ready to go home

*Where indicated, SC rHCG 83µg is given on day 3 transfer after giving the gestone

- When client is ready to go home, she is given instruction on how to take the gestone, cyclogest, ovitrelle and suprecur (where indicated) along with a prescription for

*Tab Vasoprin 75mg daily

*Tab prednisolone 5mg BD

*Tab progynova 2mg BD or 4mg TDS (as the case may be)

- Client is then instructed to come for a pregnancy test (PT) in 3 weeks, and where PT is positive, she is to come for confirmatory TVS after another 3 weeks

Double transfer on day 5

- Here, after doing an embryo transfer on day 3, blastocyst transfer is subsequently carried out on day 5
- The blastocysts to be transferred are projected to the couple
- Client lies in supine lithotomy position following which cleaning and draping is done then pre-cervical assessment is read out once again

*The adjustment of the outersheath used on for the previous day 3 transfer is also stated

- Transabdominal USS is done to locate the uterus, endometrial lining and embryos transferred on day 3
- The gauge on the outersheath is then adjusted such that there would be at least a 1cm gap between the site where the day 3 embryos were transferred and the present site where the blastocysts are going to be deposited

*Cervical mucus is usually not aspirated, though it could be done with great caution

- Blastocysts are then deposited in the uterine cavity under direct UUS visualization

*Both embryos deposited earlier, and blastocyst deposited should be clearly visualized

- Transfer catheter is examined for any retained blastocysts
- Cyclogest, gestone are administered and client is transferred to the recovery room
- When client is ready to go, she is given her prescription and other instruction and asked to come for a pregnancy test (PT) in 3 weeks.

EMBRYO TRANSFER

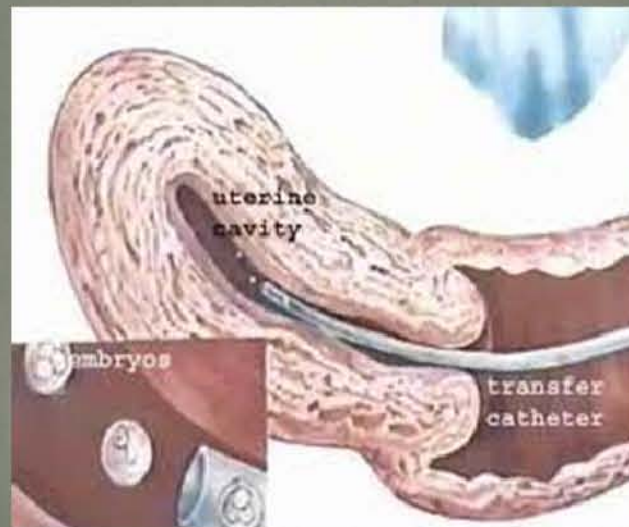
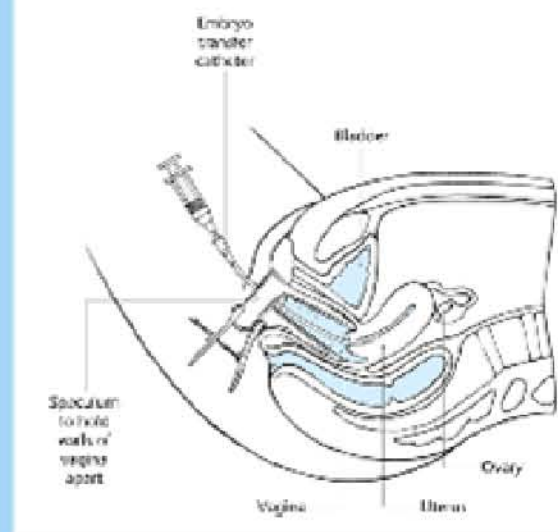


Illustration of the Embryo transfer process (Note the distance between the uterine fundus and the tip of the inner sheath of the embryo transfer catheter in (A) and (B))

embryo transfer

The three most suitable embryos are placed in the uterus



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EJACULATED SEMEN (SLOW FREEZING)

PROCEDURE

1. Label the sample
2. Place in incubator for 30 min to liquefy
3. Perform routine semen analysis (i.e. PH, motility, concentration, vitality and morphology)
4. Dilute sperm in 1:1 with sperm rinse media in a test tube
5. Centrifuge for 2500rpm for 5 min
6. Discard the supernatant
7. Add 0.75ml sperm rinse media to the residue and 0.75ml Test yolk buffer (TYB) medium and mix well.
8. Attach 1ml syringe to the end of the straw and withdraw 0.5ml per straw, seal the end of the straw with a sealer or hot forceps and label.
9. The straws are placed on a rack at a distance of 15-20 cm above the level of liquid nitrogen for 15 min after which the straws are placed in a cassette horizontally and immersed in liquid nitrogen.

SEMEN (THAWING)

1. Take out the straws and allow to thaw at room temperature for 15 min
2. Cut open the straw and transfer the sperm into a test tube
3. Examine the test straw i.e. analysis
4. Wash the sperm using simple wash method.

EMBRYO VITRIFICATION

1. Prepare all the dishes (Equilibration and vitrification) at 37°C
2. Fill the SmartBox with liquid nitrogen to the top and open the Rapid-i kit. Place the Rapid-i in a dish
3. Label the Rapid straw with the patient ID and place the Rapid straw in the smart box with the metal rod still inside.
4. Place embryos in VIT₁ solution and start the timer, embryos should stay in this solution for at least 5 minutes for maximum benefit of the hyaluronan in the solution.
5. Transfer embryos to VIT₂ solution and allow to stay for 2 minutes.
6. Prime the pipette with VIT₃ solution before picking up the embryo and load the into the hole of the Rapid-i.

7. Drop the Rapid-i into the straw placed in the SmartBox and at the same time cover the straw opening with your hand without closing the straw entirely.
8. Seal the RapidStraw, inspect the seal and transfer the RapidStraw to the goblet for storage without lifting it out of liquid nitrogen. Note that the bottom black line on the Rapid-i must be submerged under LN₂ at all times.
9. Cut down the goblet by approximately 1.5cm, mark the edge of the cut down goblet with a marker and transfer into storage tank.

WARMING

1. Prepare warming dishes and let the solution attain 37⁰ C as for vitrification.
2. Fill the SmartBox with LN₂ and retrieve the RapidStraw from storage.
3. Make sure that the Smartbox is placed very close to the microscope.
4. Remove the lid of the dish, cut the straw just above the mark tab on the Rapid-I inside the straw, cut above the top mark line on the straw.
5. Use the needle-nose tweezers to pick the Rapid-i up from inside the straw. Lift it approx. 1 cm. This is enough to allow you to grab it with your fingers. Put down the tweezers.
6. Transfer the embryo to Warm 2, Warm 3 and Warm 4 according to protocol.

Luteal Phases Support

This is an absolute requirement, especially for pregnancies from IVF, pregnancies from ovulation induction (especially those where gonadotropins were used), and pregnancies in PCOS clients

DRUG	DOSE	COMMENCE	TERMINATE
Cyclogest	800mg BD Pessaries	- Own-Egg client: day of oocyte retrieval - Recipient client: day fertilization is confirmed - Others: when PT is +ve or gestation sac seen	When placenta is fully formed and functional (usually about 20weeks)
Gestone	100mg every 3days IM injection	- IVF clients: day of embryo transfer - Others: when PT is +ve or gestation sac seen	Same
Vasoprin	75mg daily Tablet	Day of embryo transfer	Same
Prednisolone	5mg BD	Day of embryo transfer	Same
Progynova	- Own-egg: 2mg BD - Recipient: 4mg TDS	Day of embryo transfer	Same
Duphaston	Tablet 10mg daily Tablet	After discontinuing other support drugs (at about 20weeks) Day 6	Term/Delivery
Suprecur	1mg stat SC injection	Day 3 and day 8 OR Day 8 alone	
Ovitrelle	83µg stat SC injection		

- Ovitrelle is not used for luteal phase support in clients with risk factors for PCOS
*It can be used safely for all clients using donor cycle (recipients)

*However, day 8 alone rHCG could be used after proper client selection, to minimise the risk of OHSS (i.e. in clients with risk factors for OHSS e.g. PCOS, endometriosis, etc.)

- Following Pregnancy Test
*Where positive, client is to come for a confirmatory TVS in 3 weeks (i.e. 6 weeks from embryo transfer), while she continues her support

medications

*Where negative, client is asked to discontinue all her medications and await menses

- Elective cervical cerclage is carried out between 13-16 weeks
 - *For all IVF pregnancies
 - *Other clients after proper selection
- Delivery is usually carried out via Elective Caesarean Section (ELCS) at 38 weeks
 - *For all IVF pregnancies (unless other circumstances prevail)



Some of the medications used for luteal phase support (A) Gestone (B) Cyclogest

Preparing Clients For Fertility Surgery

CLIENT REVIEW

- Note client's age, parity and LMP
- Review clinical history (presenting complaint, significant findings from history including treatments client has had so far)
- Review indication for the surgery
- Review client's medical history (presence of medical conditions, medications and previous surgical history)
- Discuss the entire surgery process with the client (including possible complications)
- Discuss the choice of anaesthesia to be used for the surgery (General anaesthesia, Subarachnoid Block, Low spinal, etc.)
- Obtain informed consent (client to fill the consent form)
- Carry out thorough clinical examination on the client (checking for anaemia, presence of complications of hypertension where necessary, listening to the chest, etc.)
- Invite anaesthetist to review the client where indicated.

PRE-OPERATIVE INVESTIGATIONS

- Full Blood Count (FBC) with differential
 - Pack Cell Volume (PCV)
 - Serum Pregnancy Test
 - Urinalysis
 - Viral screening (retroviral screening, hepatitis screening, etc.)
-
- * ±Fasting/Random Blood Sugar (FBS/RBS)
 - * ±Electrolytes, Urea and Creatinine (E/U/Cr)
 - * ±Chest X-ray (for hypertensive clients)
 - * ±Electrocardiography (ECG) for clients above 40 years
 - * ±Grouping and Cross Matching (for open surgery, but usually not done for laparoscopic surgeries as blood loss is usually not significant)

PRE-OPERATIVE MEDICATIONS AND INSTRUCTIONS

- Client is instructed to not take in any food from 8pm the night before the surgery (on occasions, the client might be placed on liquid diet the day preceding the surgery)

- Client is placed on
 - *Suppository/Tabs Dulcolax 1 Nocte (the night before the surgery), and 1 by 6am (on the morning of the surgery)
 - *Tabs Misoprostol 400µg to be inserted in to the posterior fornix of the vagina at 10pm, and 6am
 - *Tabs Diazepam 10mg nocte and by 6am (to be swallowed with little water).

ANAESTHETIST REVIEW

- After all the above evaluations, the client is then reviewed by the anaesthetist in preparation for the surgery.

EXAMPLE:

F/34yr old P0+2 lady, LMP=18/98/17 who presented 3 months ago on account of infertility of 3yrs duration. TVS showed multiple follicles, with hormone profile showing elevated FSH:LH ratio, HSG and SFA were found to be normal.

An assessment of secondary infertility secondary to PCOS was made and client subsequently had 3 cycles of ovulation induction with poor response and is presently being worked up for LOD on account of CC-resistant PCOS. She is not a known HTN, DM and is presently not on any medications

o/e: afebrile, not pale, not dehydrated, no pedal oedema

CVS: PR=84bpm, normal volume, regular BP=110/70mmHg HS= S1, S2

Chest: RR=16cpm, BS=vesicular, no added sounds

Abdomen: NAD

Assessment: Secondary Infertility secondary to CC-Resistant PCOS, for LOD

Plan

Counsel client for surgery

Obtain informed consent

FBC+PCV, serum PT, viral screening, urinalysis

Client to skip dinner tonight against surgery tomorrow

Supp Ducolax, Tab misoprostol, Tab diazepam

Anaesthetist to review.

Laparoscopy Overview

GENERAL

- Client arrives, and is taken in to change from home attire into a sterile gown and head cover
- She lies supine on the operating table and an intravenous cannula is sited and intravenous fluid (0.9% normal saline) is commenced.
- Blood pressure measuring cuff is placed on the contralateral arm, along with pulse oximetry probe, and her baseline vital signs are recorded (temp, BP, PR, RR, SPO₂)
- General Anaesthetic medications are administered, the client is intubated and commenced on mechanical ventilation, with regular monitoring/charting of her vital signs
- With client fully asleep, catheterization is done using aseptic technique
- Client Positioning: Both lower limbs are suspended using Lloyd Davis stirrup and the leg part of the table is brought down with diathermy plate placed under the client's buttocks
- Surgeon and the assistants then proceed to scrub
- Cleaning and draping: Routine cleaning of the anterior abdominal wall, thighs, perineum and vagina is done, then the client is draped using leggings and abdominal drapes, with the head part of the client screened by the anaesthetist.
- Laparoscopic equipment (camera, light source, diathermy and gas cables, irrigation tubing and suctioning tubing) are cleaned using methylated spirit soaked gauze, and carefully passed on to the assistant who places them gently over the client's chest.

ERGONOMICS, PNEUMOPERITONEUM, PORT PLACEMENT CAMERA HANDLING AND DIAGNOSTIC LAPAROSCOPY

- The surgeon's monitor should be at a distance (of 5x the diagonal length of the monitor) from the surgeon, and should be at the same eye level with the surgeon's eye; while the monitor screen for the assistant should be positioned such that he doesn't strain his neck to view it (while the surgeon's screen is placed opposite the

surgeon, that of the assistant is positioned to face the assistant from towards the feet of the client)

- The height of the operating table should be brought down to the lowest point, so it would be at the level of the surgeon's waist
- Pneumoperitoneum and Primary port placement
 - * A stab wound is created on the skin above the umbilicus, then with the anterior abdominal wall grabbed and lifted (possibly with a pair of gauze) by both the surgeon and the assistant, the veress needle is held like a pen, and gently inserted (at an angle to the anterior abdominal wall, facing towards the pelvis of the client) into the peritoneal cavity with movement only at the wrist. The gas cable is connected to the veress needle and peritoneal insufflation commenced
 - Percussion over the anterior abdominal wall, while insufflation is ongoing serves as a test for pneumoperitoneum (which is said to be adequate when there is loss of hepatic dullness, and a hypertympanic percussion sound is obtained uniformly around the abdomen)
 - * With adequate pneumoperitoneum, the veress needle is removed, and the skin incision is extended to about 2cm, then blunt dissection of the subcutaneous tissue is done using artery forceps
 - * A 10mm (or 5mm) port with trocar, held like a pistol (placing the index finger midway of the length of the port to avoid damaging internal organs) is gently inserted through the extended incision (while lifting the anterior abdominal wall), while making screw-like motions at the wrist
 - * After placing the port, remove the trocar and clean the inner part of the port using a clean dry gauze and an artery forcep, then connect the gas cable to the port and open the valve to help maintain pneumoperitoneum
 - * Connect the camera and light source to the telescope (10mm or 5mm as appropriate), carry out white balancing (by placing over a clean dry gauze) then gently insert the telescope into the port to view the peritoneal cavity
- Uterine manipulator insertion
 - * A Sims speculum is used to retract the posterior vaginal wall to identify the cervix, which is grabbed with the aid of a tenaculum, at the upper lip, while

identifying the external Os

* The functionality of the uterine manipulator is tested, before it is gently inserted through the external Os of the cervix, into the uterine cavity and used to elevate the uterus, while it is being viewed on the screen

- Stenosed cervix will be dilated serially to enable insertion of the uterine manipulator

• Secondary port placement

* The secondary ports are inserted about 6cm lateral to the primary port, and a little bit caudal to it (obeying the rule of the Diamond Baseball concept, to achieve a manipulation angle of 60°, and avoid overcrowding of the instruments on the skin surface) under direct vision

* With the telescope at anatomical position, it is turned towards the side where the secondary port is to be placed, while the surgeon makes a depression on the identified spot for the port placement so as to identify this point from within, to ensure no major blood vessel is along its path

* A small 2cm incision is made in the skin over this spot, and blunt dissection carried out using an artery forcep, then the port and trocar is gently inserted (as in the primary port) while being visualized from within to identify the entry point and to avoid injury to internal organs as it goes in. ensure that the valve of the port is closed to prevent escape of gas from the peritoneal cavity.

* After inserting the secondary port, a bowel retractor is inserted via this port and used to retract the bowel (while the uterus is elevated, thus exposing the pouch of Douglas) until the sacral promontory is visualized, while the head of the operating table is tilted downwards

• Camera handling

* The camera is held by the assistant with the settings buttons facing anterior (without altering the settings), to view the peritoneal cavity without showing the rim of the port

* Anatomic view: Holding the camera in a central position, so as to view the organs in their ideal anatomic positions (i.e. the uterus is central, with the tubes and ovaries lateral to it)

*Panoramic view: To view the entire peritoneal cavity by rotating the camera and port through 180° to the left and right; thus, viewing the bowel loops, paracolic gutters, liver surface, stomach and diaphragm

*Manipulations: During the procedure (e.g. picking an introduced needle, suturing/knotting, ovarian drilling, grasping of adhesions/fallopian tube/ovarian ligament, etc.) the camera is moved closer to get a proper of the ongoing activity, to limit errors and accidents.

Diagnostic laparoscopy

*After proper bowel retraction, a thorough diagnostic laparoscopic procedure is carried out, inspecting the uterus, fallopian tubes, ovaries, tubo-ovarian relationship and peritoneal surfaces; identifying pathologies/anomalies present (the general theatre light is turned off until it is required)

Note

- Care should be taken to avoid contact between the telescope and other surfaces such as omentum, bowel, etc., as this could result in blurring of the images on the screen

- When the images appear blurred, remove the telescope and clean with dry gauze. If the blurring persists, dip the tip of the telescope into a gallipot containing hot water and then clean again with dry gauze before inserting gently into the port to proceed.

THERAPEUTIC LAPAROSCOPY

Several therapeutic laparoscopic procedures/ interventions can be carried out in one surgery. Gynaecological procedures that could be carried out include:

*Laparoscopic Adhesiolysis

*Laparoscopic Dye-test

*Laparoscopic Tubal cannulation (with concomitant hysteroscopy)

*Laparoscopic Tubal disconnection

*Laparoscopic Salpingostomy

*Laparoscopic Salpingectomy

*Laparoscopic Ovarian Drilling

*Laparoscopic Ovarian Cystectomy

*Laparoscopic Myomectomy

*Laparoscopic Retrieval of translocated IUCD

After completion of the therapeutic intervention, tissue retrieval is then carried out, depending on the size, consistency and nature of the tissues to be retrieved as follows

*Through the port

*Removal of the tissue along with the port

*Use of tissue retrieval bag/ endobag

*Use of improvised endobag (using sterile latex gloves or condoms)

*Use of morcellator (for fibroids)

*Through posterior colpotomy

CONCLUSION

After complete removal of all tissues, the peritoneal cavity is irrigated with at least 1L of normal saline, irrigating surfaces of the ovary, uterus, tubes and especially the areas worked upon

After irrigation, note the estimated blood loss in the course of the surgery by noting the amount of blood in the suction jar, then commence suctioning of all the free fluid in the peritoneal cavity, including fluid trapped within bowel loops and those in the paracolic gutters (by carrying out a panoramic view of the entire peritoneal cavity with the telescope), while the head of the client is tilted back up so most of the free fluid gravitates towards the POD

*Compare the amount of fluid suctioned into the suctioning jar, to that used for irrigation, so as to ensure that most (if not all) of the fluid used for irrigation have being suctioned out

Where dye-test is carried out, the endometrial cavity is irrigated copiously with at least 500mls of normal saline, to prevent sterile endometritis with resultant menorrhagia in next menses

PORT REMOVAL AND CLOSURE

After complete suctioning, port removal and closure is carried out either blindly or with the use of a port closure needle under vision

Blind port closure

*All the ports are removed, then excess gas expressed from the peritoneal cavity

*With absorbable vicryl-1 suture, a deep bite is taken and tied (in an attempt

to close the rectus sheath). This is especially carried out for port sizes $\geq 10\text{mm}$ to prevent occurrence of Richter's hernia

*Then either nylon-0 or vicryl-0 suture is then used to close the skin using either interrupted mattress or subcuticular continuous stitches respectively

*Little sterile gauze dressing is then applied over the stitches and plaster applied over the dressing

Port closure under vision

*With all the ports still in place with telescope and other working elements, a port closure needle is used to introduce a vicryl-1 suture into the peritoneal cavity, from one side of the port, and picked out from the other side of the port, via the subcutaneous tissue, sparing the skin (i.e. the needle does not pierce through the skin); thus forming a loop that would contain the peritoneum, rectus sheath and muscle, as well as the subcutaneous tissue

*This process is repeated for all the ports, especially those that are $\geq 10\text{mm}$, before all the ports are removed and the excess gas expressed, then the vicryl-1 suture loops are all tied

*Either nylon-0 or vicryl-0 suture is then used to close the skin using either interrupted mattress or subcuticular continuous stitches respectively

*Little sterile gauze dressing is then applied over the stitches and plaster applied over the dressing

Note

*Every vital step in the course of the surgery should be recorded adequately, as this recording would be used for the post-operative counselling, and also handed over to the client (i.e. where facilities to record are available)

POST-OPERATIVE CARE

After the surgery, the anaesthetist would note the post-operative vital signs, then administer the reversal medications, and subsequently extubate when client achieves spontaneous respiration, then record the post-extubatory vital signs (including SPO₂ in room air, urine output and EBL)

Post-operative analgesia is administered, then the client is gently transferred to the recovery room, where she is left to sleep until she regains full consciousness, after which the intravenous cannula and urethral catheter are removed and client

changes into her home attire and she is ready to go home

Obtained specimen are placed in a container with tissues fixative (formaldehyde), sealed, labelled and handed over to the client relative along with a well filled request form for histology (where applicable)

Client is then given a copy of the recording from the surgery, along with a prescription for:

*Tab metronidazole 400mg TDS x1 week

*Tab ciprofloxacin 500mg BD x1 week OR Tab cefuroxime 500mg BD x1 week

*Tab ibuprofen 400mg BD or TDS x5 days OR Tab diclofenac 100mg BD or TDS x5 days

Client is instructed to come for a follow-up visit in one week, where the video from the surgery is reviewed, further treatment modality discussed and then stitches removed (as applicable)

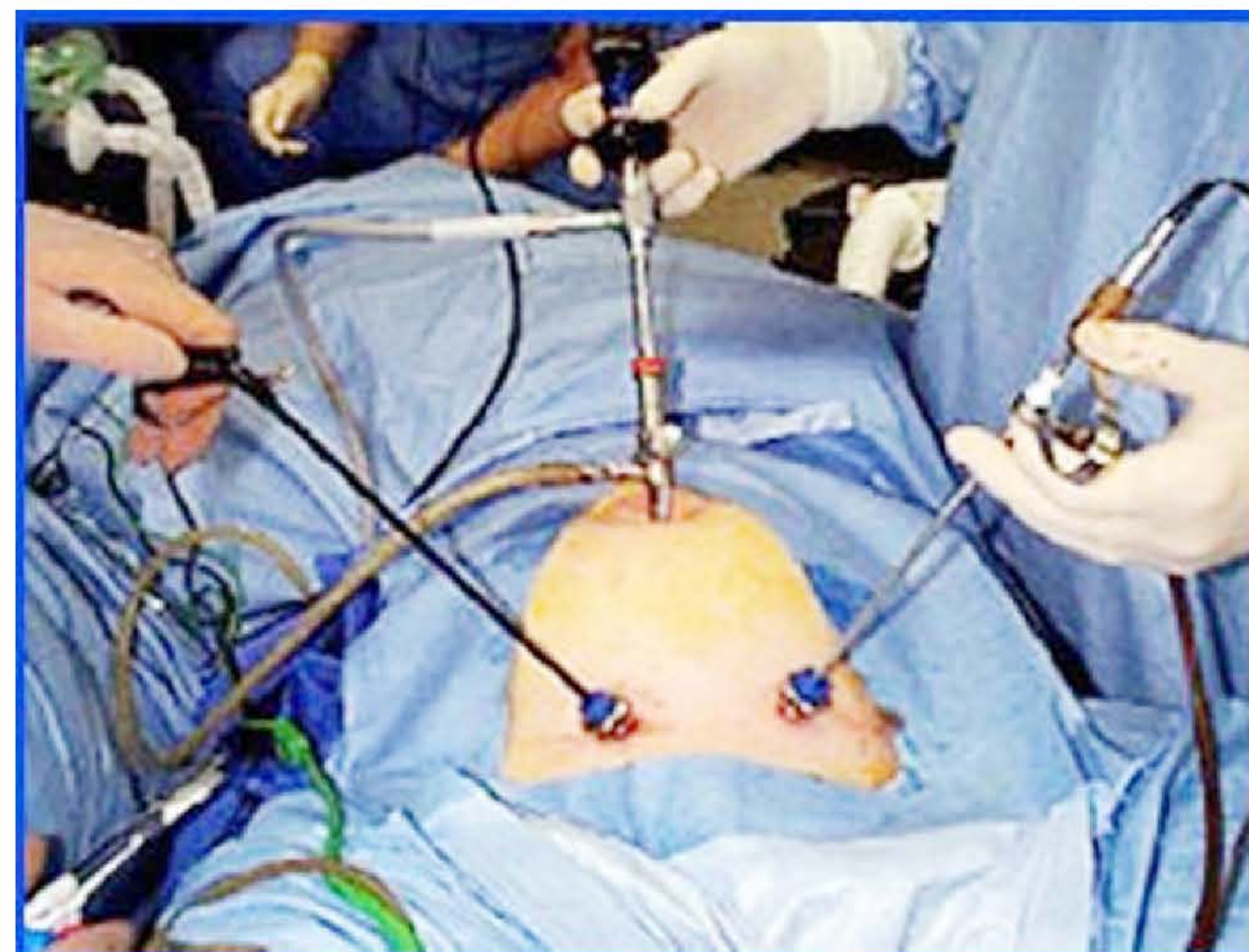


Illustration of an ongoing laparoscopy surgery showing the port placement (Note the Primary Port which contains the telescope, camera, light source and gas cable; and the two Secondary Ports)

GENERAL

- This is similar to the general steps for laparoscopy, although, hysteroscopy could be carried out using SAB
- Hysteroscopic (camera, light source, suction and irrigation tubing, and diathermy cable) equipment are passed to the surgeon

ERGONOMICS, INSERTION OF THE HYSTEROSCOPE AND DIAGNOSTIC HYSTEROSCOPY

- With the surgeon seated at the perineal side of the table, the height of the table is adjusted to the comfort of the surgeon
- A Sims speculum is used to retract the posterior vaginal wall, exposing the cervix which is grasped at the upper lip with the aid of a tenaculum, identifying the external Os
- Insertion of hysteroscope
 - * The hysteroscopic working element is then coupled (with the telescope, camera, light source, irrigation and suction tubing and diathermy cable) and passed into the cervical canal, via the external Os, using either normal saline or glycine as the distention medium
 - Stenosed cervix will be dilated serially to be able to accommodate the hysteroscopic working element
- Diagnostic hysteroscopy
 - * A thorough diagnostic hysteroscopy is then carried out carefully, and systematically; looking at the cervical canal, uterine cavity and identification of both tubal ostia/opening. Any anomaly/pathology present is noted

THERAPEUTIC HYSTEROSCOPY

- Therapeutic procedures/interventions that could be carried out include:
 - * Hysteroscopic Adhesiolysis (for intracervical and intrauterine adhesions)
 - * Hysteroscopic Endometrial biopsy
 - * Hysteroscopic Endometrial ablation (for endometrial hyperplasia)
 - * Hysteroscopic Polypectomy (for endometrial polyps)

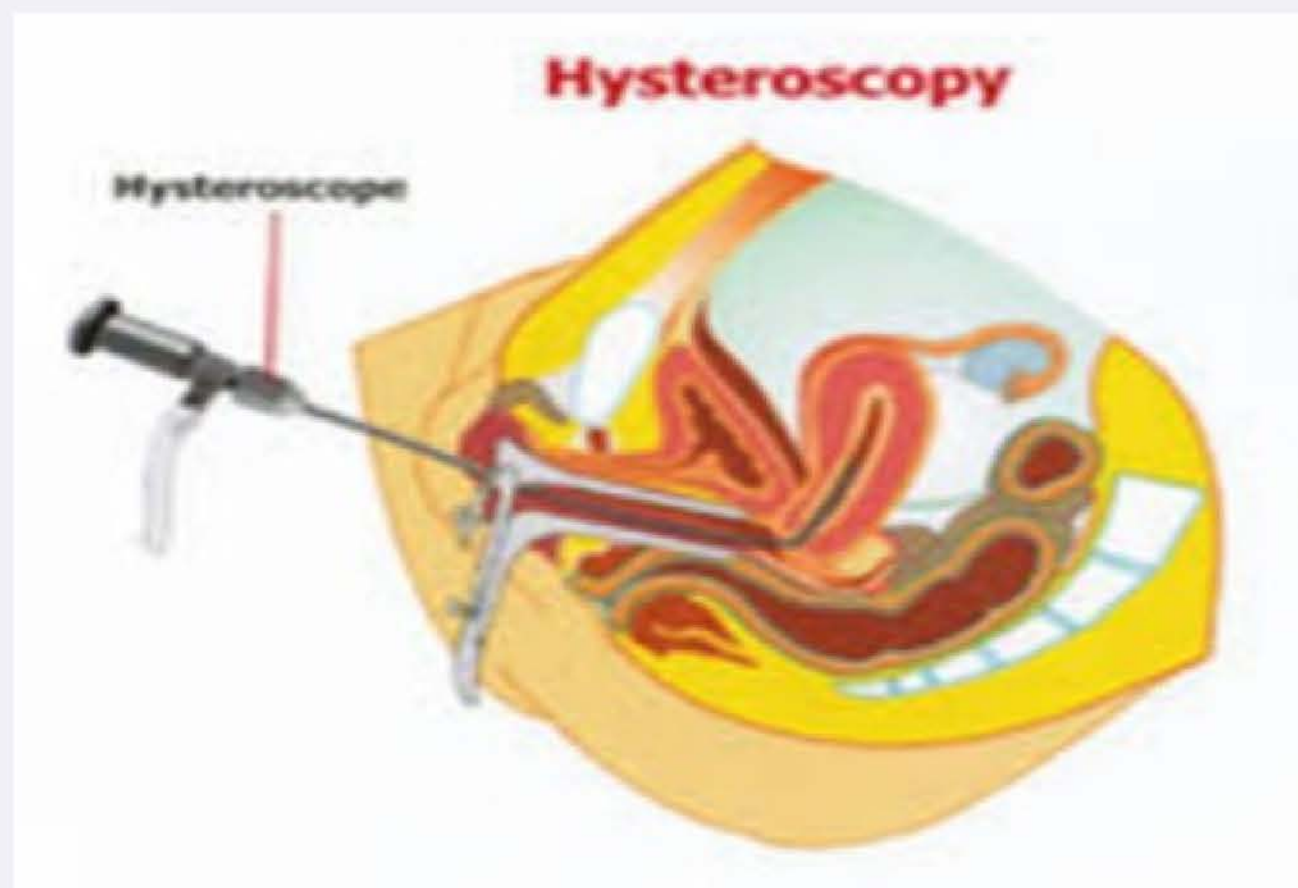
- * Hysteroscopic Myomectomy (for submucous fibroids)
- * Hysteroscopic Metroplasty (for uterine septum and other congenital uterine anomalies)
- * Hysteroscopic Retrieval of displaced IUCD
- * Hysteroscopic Tubal cannulation

CONCLUSION

- After completing the therapeutic intervention, another diagnostic hysteroscopic procedure is carried out to reassess, and when satisfied with the findings, the working element is removed from the uterine cavity and uncoupled
- Placement of an IUCD or a paediatric Foley's catheter (size 7) is then carried out to prevent occurrence/recurrence of intrauterine adhesions

POST-OPERATIVE CARE

- This is similar to that of laparoscopy
- A stat dose of IV Frusemide 40-60mg might be given in cases where excess fluid absorption is suspected
- Upon discharged home, client is given a prescription for analgesic, antibiotics ± prednisolone, and also given another prescription for
 - * Tabs progynova 2-4mg BD or TDS for 35 days
 - * Tabs primolut-N 10mg TDS for one week, starting from day 29 of progynova
- After completing above medication, client is to wait for commencement of withdrawal bleeding, after which she is to repeat above combination of drugs for at least the next 3 cycles



A Diagrammatic Illustration of Hysteroscopy

Care Of Endoscopic Equipment And Their Maintenance

PRE-OPERATIVELY

- Laparoscopic machine and accessories
 - * Light source cable is connected and tested
 - * Camera and monitor is turned on and assessed
 - * Diathermy apparatus are tested to ensure they are all working
 - * Level of gases in the cylinders (CO₂ and O₂) are checked, and arrangement for a new cylinder is made if the gas level is low
 - * Insufflator is also checked, along with the irrigation and suctioning mechanism
 - * Client details are entered into the recording device
- Laparoscopic working elements
 - * All working elements are sterilized using chemical sterilizer (cidex- constituted as 25mls/L of water) by soaking for 10-15 minutes, after which they are removed and then soaked in a disinfectant solution (constituted as 25mls/5L of water) and remain there until use
 - All equipment to be used must be rinsed thoroughly in clean water after removing from the disinfectant solution, and coupled together
 - * A sterile laparotomy pack (containing Sims speculum, tenaculum, artery forceps, sponge holding forceps, needle holder, scissors, Hegars dilator set, gallipot, kidney dish, etc.) is also opened with aseptic technique
 - * A sterile area is then prepared where all the rinsed and coupled working element will be placed, along with other needed equipment from the laparotomy pack, draping, surgical gowns and gloves, gauze and gallipot containing lotion for cleaning.

POST-OPERATIVELY

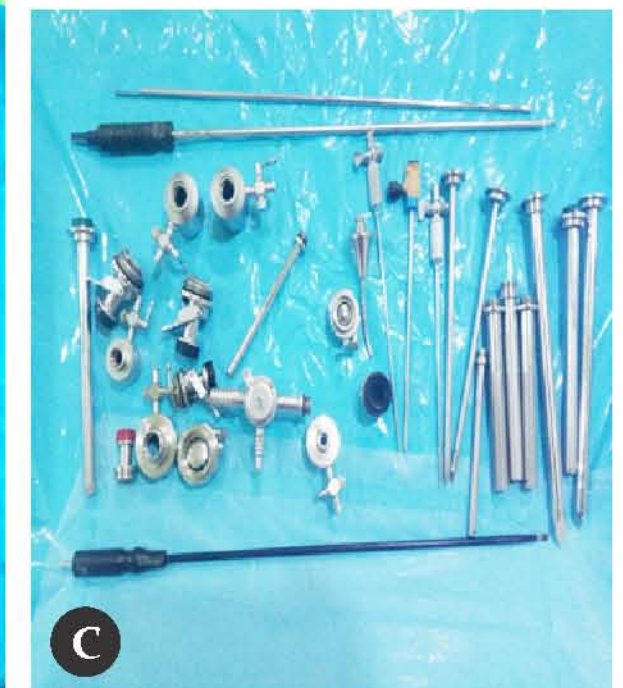
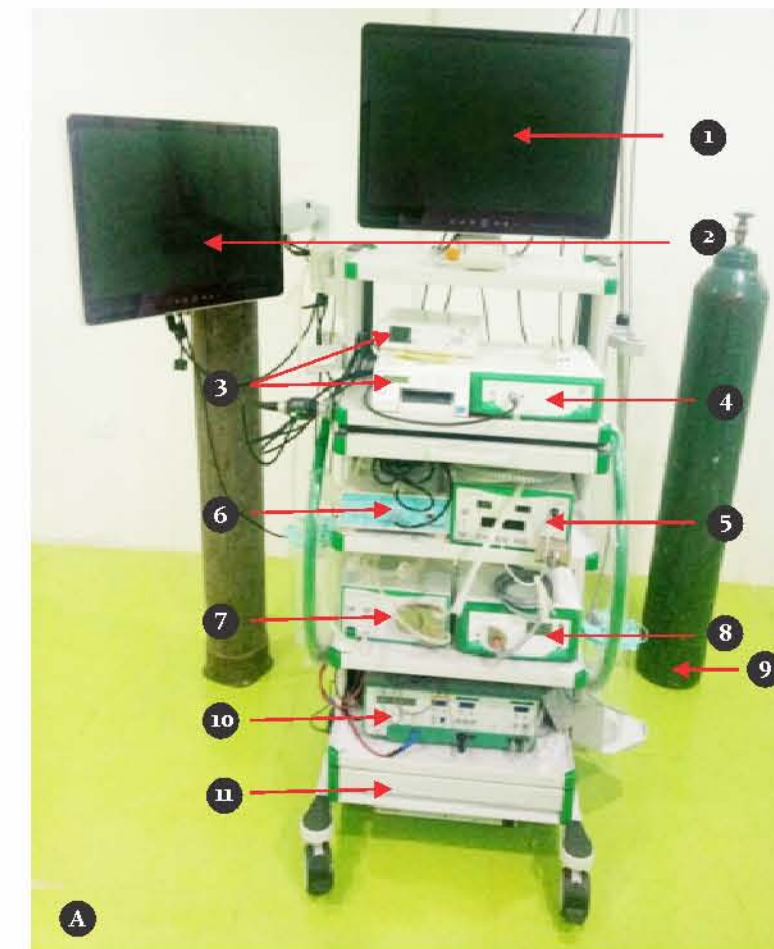
- Laparoscopic machine and accessories
 - * Monitor, light source, diathermy, insufflator, suction machine, etc. are all turned off
 - * All cables are cleaned properly with methylated spirit and kept neatly in a

dry environment, avoiding excessive folding and kinking of the cables and tubing

- * Level of the gas should be checked, and arrangement to refill/replace them made before the next surgery
- * Faulty devices in the course of the surgery should be repaired promptly, and/or replaced where applicable

Laparoscopic working element

- * All working element and other equipment used for the surgery are washed under running water, uncoupling all that can be uncoupled (ports, some forceps, etc.), flushing the lumen of all which have lumen, and possibly brushing them also
- * After thorough washing, all the equipment is air dried
- * After air drying, materials taken from the laparotomy pack are replaced, repacked, autoclaved and stored for the next procedure; while the laparoscopic working elements are neatly placed back into their packs until the next surgery when they are sterilized again



(A) A Complete Laparoscopy suit (Note the carefully folded cables) 1: Surgeon's screen 2: Assistant's screen 3: Recording device 4: Camera 5: Insufflator 6: Morcellator with pedal 7: Suction/Irrigation system 8: Light source 9: Carbon Dioxide cylinder 10: Diathermy system 11: Drawer

(B) Laparoscopy working elements

© Washed and uncoupled laparoscopy ports and trocars with reducers

After successful placement of the first secondary port, a bowel retractor is inserted and used to retract the bowel from the POD, while carrying out diagnostic laparoscopy.

While carrying out diagnostic laparoscopy, some procedures might be carried out to separate and properly visualise structures (i.e. adhesiolysis), or to test the functionality of some of the organs visualised (e.g. Dye-test). These procedures are thus referred to as preliminary

LAPAROSCOPIC ADHESIOLYSIS

MATERIALS

- 5mm secondary port
- Maryland forcep
- Scissors
- Monopolar coagulative current

PROCEDURE

This depends on the nature of the adhesion (i.e. flimsy or dense) and its vascularity

- Flimsy, non-vascularized adhesions
 - * This can be separated by gentle traction (i.e. pulling gently) with the Maryland forceps
- Flimsy-mildly dense, vascularized adhesions could be separated by
 - * Grasping the adhesion (or tissue) with the Maryland forcep, then examine the surrounding of the grasped portion for proximity to vital organs, all of which should be avoided
 - * Apply coagulative current to the grasped area with the Maryland (diathermy cable connected to it)
 - * Then apply gentle traction on the desiccated area to separate it
- Moderately dense, non-vascular adhesions are separated by
 - * Gentle traction with the Maryland, or carefully cutting through with the scissors
- Moderately dense, vascularized adhesions are separated by

- * First applying coagulative current to the area
- * Then apply gentle traction to the area, or cut through the coagulated area with the scissors

- Dense adhesions, irrespective of the vascularization should not be tampered with (especially those associated with viscus), so as not to cause damage to the client and result in complications (such as haemorrhage, conversion to open laparotomy, prolonged hospital admission, etc.)

NOTE:

- Adhesions associated/involving viscus should be separated carefully
- Surgeon needs to recognise his limitation early enough (based on his skills and available equipment), and avoid carrying out heroic acts that might complicated the surgery
- Where adhesions are so dense, and adhesiolysis not advised/possible, carrying out diagnostic laparoscopy is impaired and thus the procedure should be terminated/abandoned (ports are removed and closed after irrigation and suctioning) and other treatment modalities considered
- Clients with history of previous surgeries (laparotomy or laparoscopy) are at increased risk of having intraperitoneal adhesions (laparotomy > laparoscopy); thus, history of previous surgery is a relative contraindication for carrying out laparoscopy

This is usually carried out to test for the patency of the fallopian tubes (a positive result means there was spillage of dye from at least one tube, which indicates patency of the tube).

Dye-test is used to confirm or refute tubal blockage as detected by HSG, and can only be carried out at any point in the cycle outside of menses.

MATERIALS

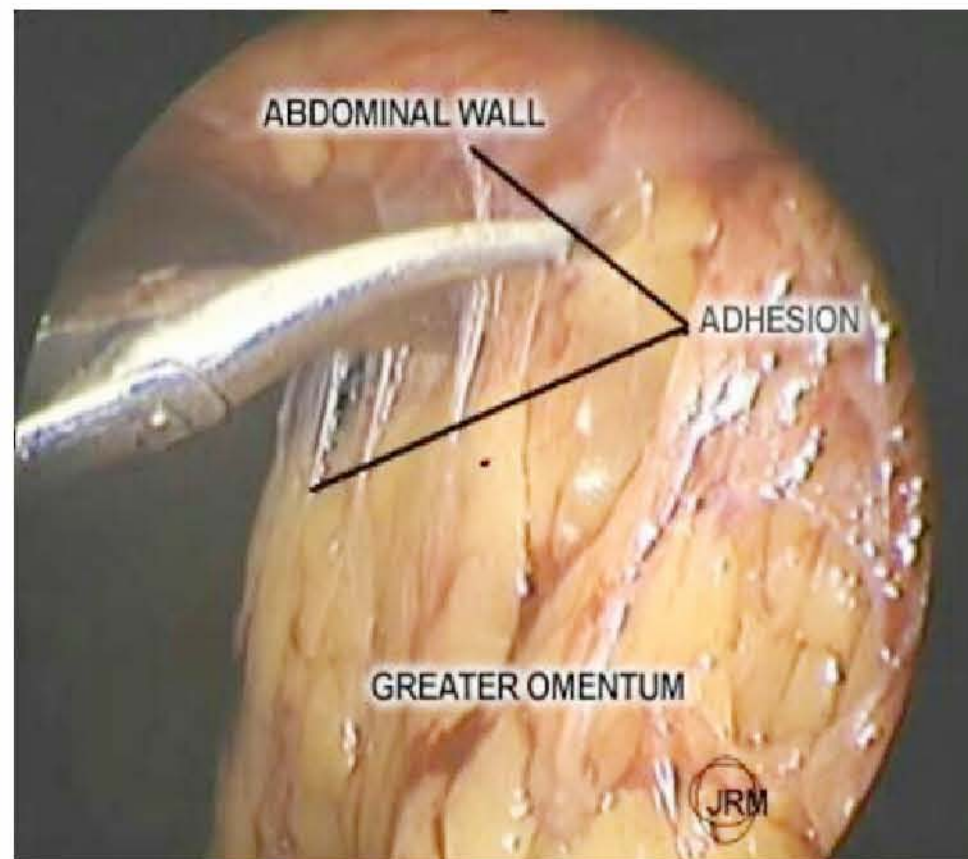
- Bowel retractor
- Uterine manipulator
- Sterile 20mls syringe
- Gallipot and diluted methylene blue dye (about 100mls)

PROCEDURE

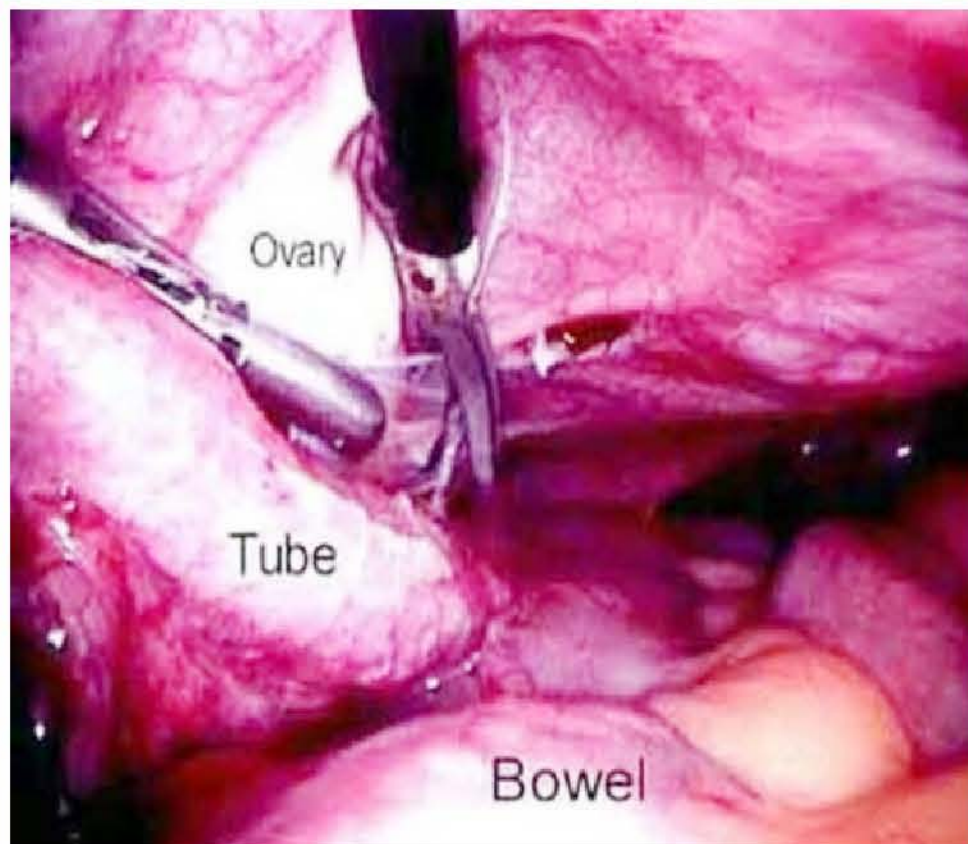
- Elevate the uterus with the uterine manipulator, while retracting the bowel loops to completely expose the POD, fallopian tubes and ovaries
- Use the 20ml syringe to withdraw dye from the gallipot and then gently inject the dye into the uterine cavity through an opening in the uterine manipulator using pressure
- While the dye is being injected into the uterine cavity, the fallopian tubes would be inspected, one tube at a time, for evidence of dye spillage into the peritoneal cavity through the tube, lifting the tube gently if need be for proper inspection. This process is repeated on the contralateral tube
- Visible spillage of dye from the tube on inspection, presence of dye stain on the tube and surface of the ipsilateral ovary (confirms good tubo-ovarian relationship) and presence of free dye in the POD are all indicative of a positive result for that tube (meaning the tube is patent)

CONCLUSION

- At the end of the procedure, the entire peritoneal surface is irrigated, especially the ovarian surface and the POD, after which the fluid would be suctioned
- While the irrigation is ongoing, the uterine cavity would be irrigated copiously by repeated injection of normal saline (about 500mls) into the uterine cavity, through the uterine manipulator



Laparoscopic adhesiolysis of adhesion between the omentum and anterior abdominal wall



Laparoscopic adhesiolysis of adhesions between the tube and posterior uterine wall (black arrow)

INDICATION

Hydrosalpinges detected on HSG (hydrosalpinges could appear on TVS and it appears like an ovarian cyst)

Hydrosalpinges has a negative effect on fertility as natural fertilization (which occurs in the tube) is impaired. In IVF, it impairs implantation and pregnancy via

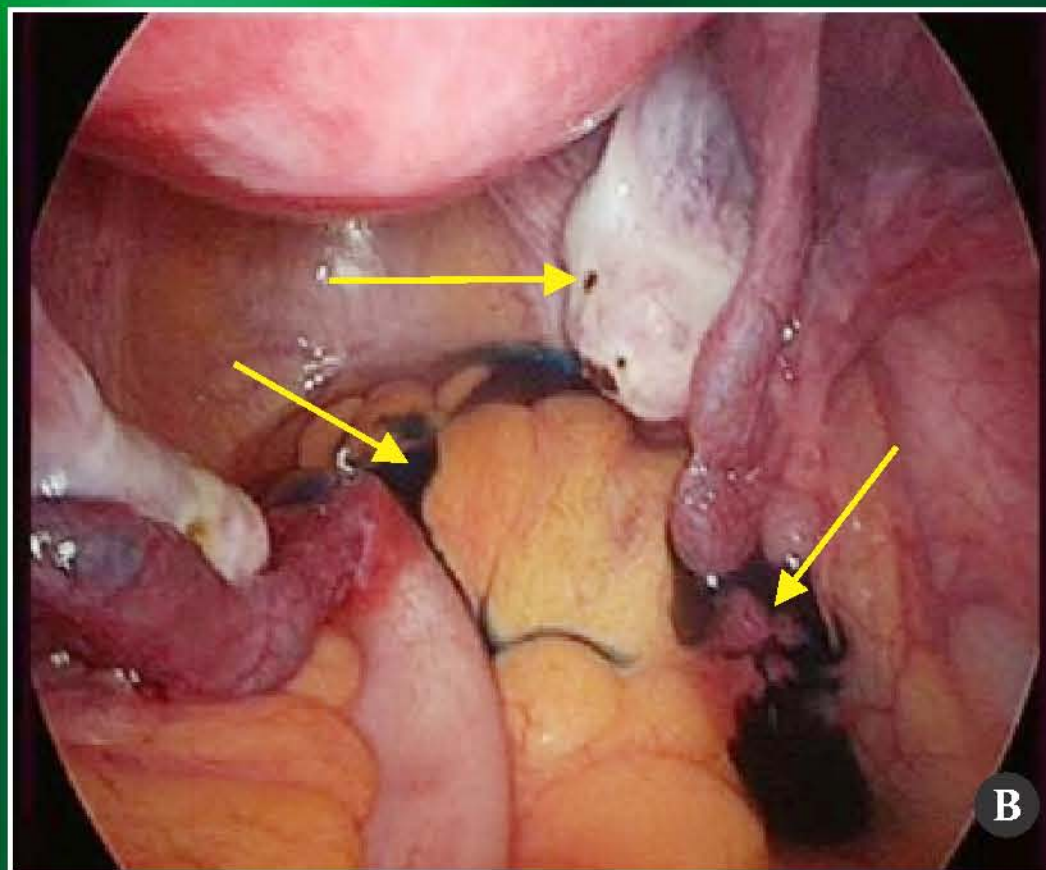
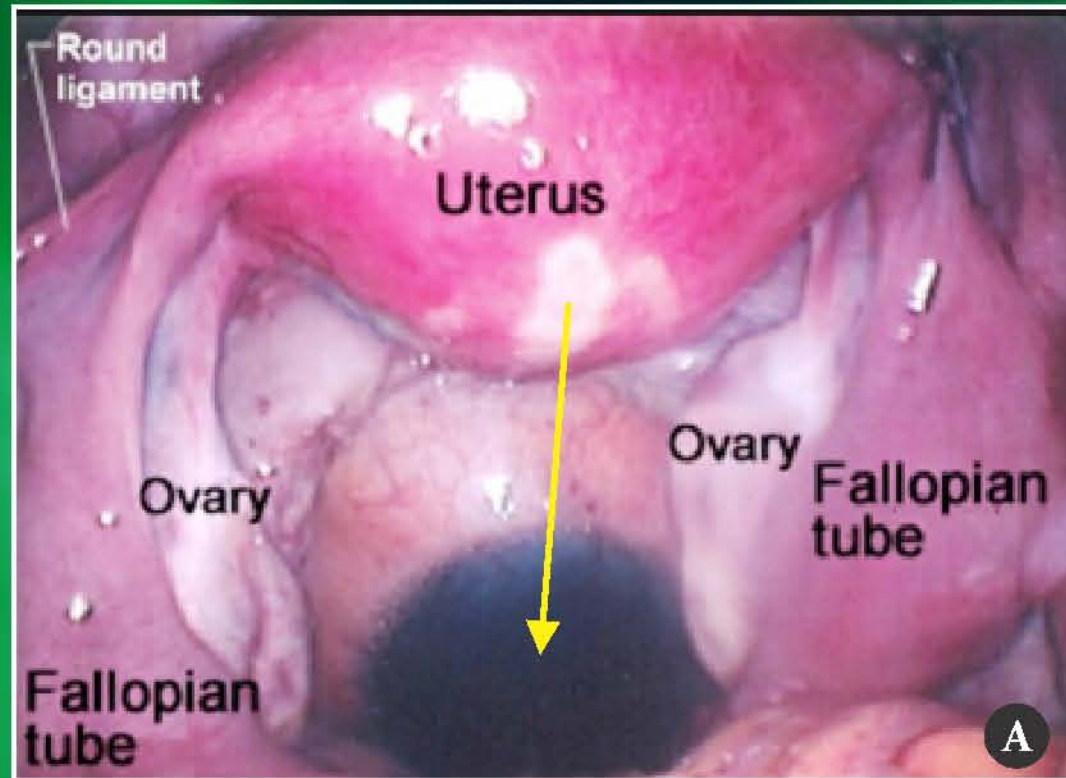
- Embryotoxic effect of the fluid trapped within the lumen of the tube that sips into the uterine cavity thus distorting embryonic development
- Mechanical pulling and pushing effect exerted by the distended tube on the uterus, thus distorting implantation and development of the embryos

MATERIALS

- One 5mm secondary port
- Bipolar diathermy forceps and cable
- Scissors
- ± injection needle

PROCEDURE

- Retract the bowel and do a thorough diagnostic laparoscopy (carrying out adhesiolysis where indicated)
- Bipolar diathermy forcep is then inserted (through the secondary port) and used to grab the fallopian tube around the mid-portion, away from the uterus, ovary and round ligament, possibly lifting it a bit so as to take it away from these structures to avoid thermal damage as a result of the coagulative current
- Coagulative current is then applied to the grasped area to desiccate the area and completely obliterate the lumen (giving this area a whitish appearance; proof that the tube is desiccated)
- The desiccated portion of the tube could be extended by using the forceps to grab another area adjacent to the already desiccated area, and coagulation carried out again, thus creating a substantial area of desiccation
- A scissors is then used to carefully cut through the tube at the at the mid-point of the desiccated area



A laparoscopic view of dyetest being carried out

(A) Note the presence of dye in the POD

(B) Note bilateral spillage of dye from the tubes and the ovary with drill puncture

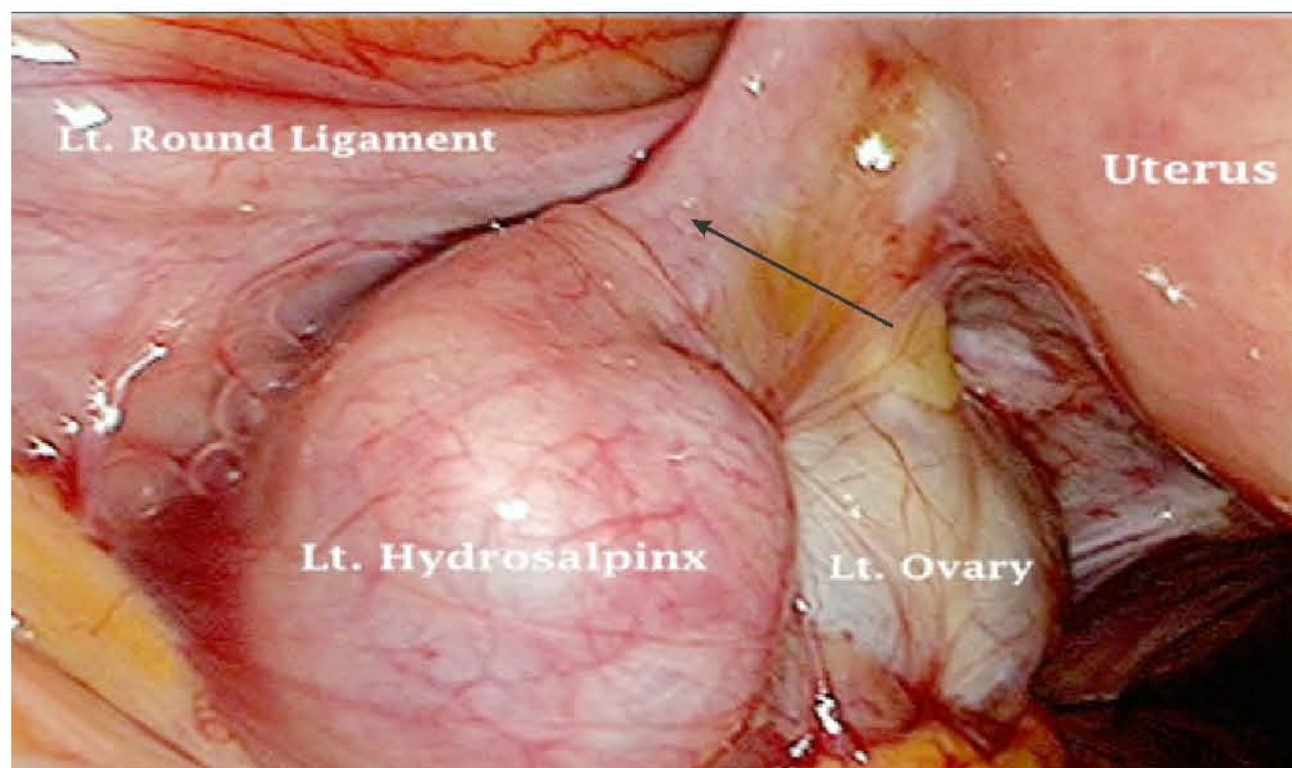
- The above steps are repeated on the contralateral tube also
- Depending on the size of the hydrosalpinges, the fluid content could be aspirated and the tube left in place

TISSUE RETRIEVAL

- This is not usually done

CONCLUSION

Laparoscopic view of a hydrosalpinx. Note the point for tubal desiccation (black arrow)
The peritoneal cavity is then irrigated, especially the desiccated/separated portion of the tubes



Laparoscopic view of a hydrosalpinx. Note the point for tubal desiccation (black arrow)

Laparoscopic Ovarian Drilling

Laparoscopic ovarian drilling (LOD) serves as a one-off treatment in CC-resistant PCOS clients to help regularize the distorted hormonal milieu of the client, thus making them attain/resume unifollicular ovulation and regularization of menses. It also serves to improve the responsiveness of the ovaries to stimulation with CC and other gonadotropins

INDICATION

- PCOS with CC-Resistance (i.e. failure to ovulate after 3 cycles of CC)
- PCOS with CC-Failure (i.e. failure to achieve pregnancy after 6 cycles of CC)

MATERIALS

- One 5mm secondary port
- Ovarian drilling needle with monopolar diathermy cable
- One alligator forcep with its introducer

PROCEDURE

- Retract the bowel and do a thorough diagnostic laparoscopy, inspecting the tubes, ovaries and tubo-ovarian relationship and carry out preliminary procedures (adhesiolysis and dye-test) where indicated.
- The introducer of the alligator forcep is passed into the peritoneal cavity by piercing the anterior abdominal wall over the suprapubic region, under direct laparoscopic vision, with the uterus down to avoid uterine injury
- The alligator forcep is then passed into the peritoneal cavity (through the lumen of its introducer), and used to grasp the ovarian ligament (as close as possible to the ovary to avoid haemorrhagic injury), with which the ovary is positioned/aligned properly. The uterus is elevated carefully during this process to expose the tubes and ovaries properly
- The monopolar diathermy cable is connected to the ovarian drilling needle, which is inserted into the peritoneal cavity via the secondary port
- Within the cavity, the piercing component of the needle is exteriorized and positioned/stabilised properly on the ovarian surface before the coagulate current is applied with which the piercing component is used to drill into the ovary, completely burying the piercing component into the ovary (i.e. 4mm depth)

- This drilling process is repeated (for a predetermined number of time/number of drills, based on the ovarian volume) on different parts of the ovarian surface, while avoiding the hilum of the ovary (so as not to compromise the ovarian blood supply)
- After achieving the predetermined number of drills (usually about 6-8), the ovarian ligament is released from the alligator forcep
- The above steps are then repeated for the contralateral ovary

NOTE

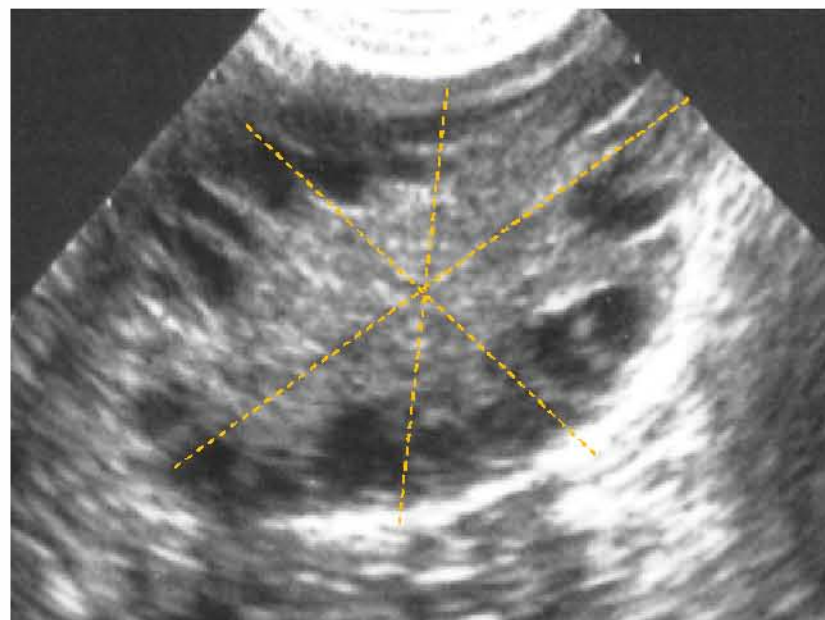
- The number of drills to be administered per ovary is determined by the ovarian volume from the TVS
- It is estimated that a minimum of 600J of energy is required to activate the ovary, therefore, an ovary with a volume of 10cm³ (diagnostic of PCOS) would get a total of 6 drills. The number of drills for subsequent volumes can then be extrapolated.

TISSUE RETRIEVAL

- This is not done

CONCLUSION

- The peritoneal cavity, especially the surface of the drilled ovary is irrigated, and fluid suctioned.



Transvaginal Ultrasound Scan of the ovary in a PCOS client showing that the ovary is enlarged, with numerous eccentrically placed follicles, dense stroma and increased cortical thickness

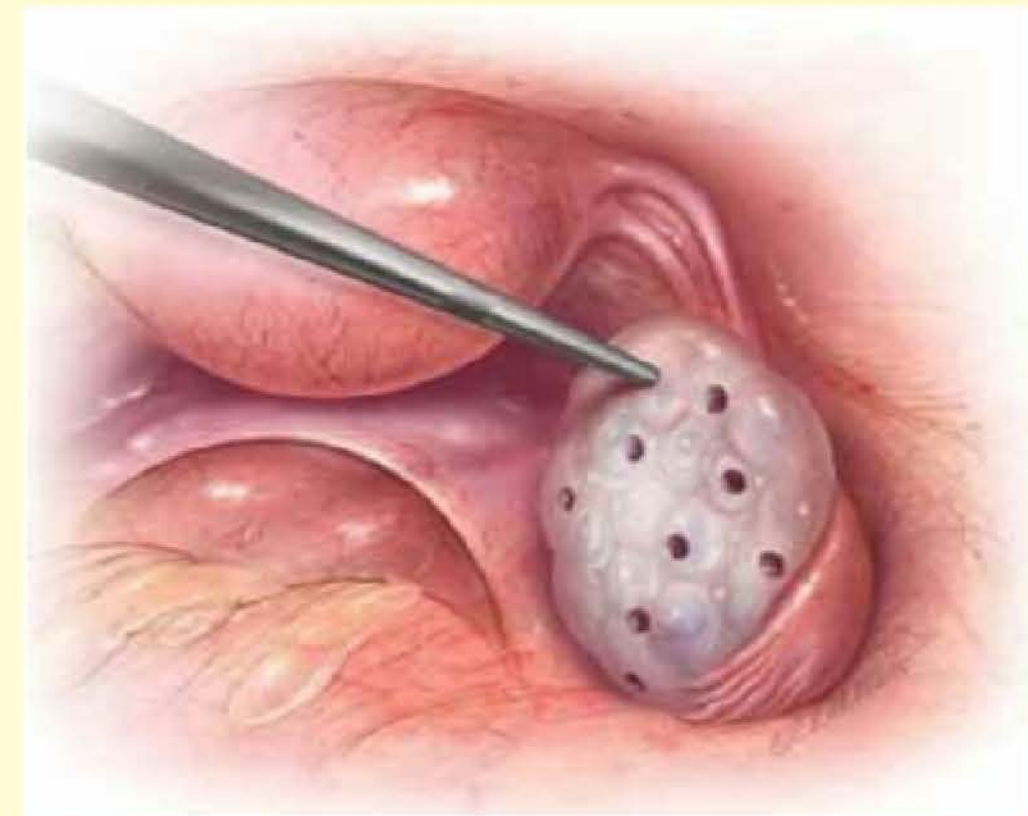


Illustration of a Laparoscopic Ovarian Drilling process



Laparoscopic Ovarian Drilling in UITH IVF Centre



INDICATION

- Endometrioma
- Huge persistent follicular cysts
- Ovarian dermoid cysts
- Other symptomatic pathological ovarian cysts

MATERIALS

- Two secondary ports
 - * One 5mm port
 - * Another 5mm port that could be converted to a 10mm port and used with a 5mm reducer
- Maryland forceps
- Claw forceps
- Spatula forcep with monopolar diathermy cable
- Tissue retrieval bag
 - * Endobag
 - * Improvised endobag e.g.
 - Size 8 sterile latex gloves tied with vicryl-1 suture just above the projection of the thumb, cut just distal to the tied portion and inverted
 - Latex condom

PROCEDURE

- After carrying out diagnostic laparoscopy, inspecting the affected ovary and other structures ($\pm$ preliminary procedures where indicated), a second secondary port is then inserted
- The spatula, connected to the monopolar diathermy cable is then inserted into the peritoneal cavity and used to carefully desiccate a longitudinal line on the surface of the cyst (without rupturing the cyst)
- Maryland forcep is inserted and used to carefully create a cleavage plane between the ovarian cortex and the inner cyst wall
- This cleavage plane is then carefully extended/dissected either

- * Manually by using the outer curved surface of the Maryland forcep to press carefully on the cyst wall, while another forcep is used to carefully grip on the free edge of the outer ovarian cortex; thus carefully creating a shearing force to separate the cyst wall from the ovarian cortex

- * Use of hydropressure by placing the irrigation nozzle close to the cleavage plane, letting the force of the emerging water shear off the cyst wall from the ovarian cortex

- As the separation process gets advanced, a claw forcep is used to grasp the cyst wall, while a Maryland forcep is used to carefully shear off the outer cortex from the cyst wall.
- Haemorrhage should be secured as surgery advances by gently applying pressure with the Maryland on the bleeding bed and accumulated blood suctioned out
 - * As much as possible, the use of electrocautery current on the ovarian cortex to secure haemostasis should be minimized/avoided so as not to compromise the ovarian reserve (by cooking the ovarian cortex)
- After the cyst has been completely separated from the ovarian cortex, the cyst is deposited in the POD, while attempt to secure haemostasis is carried out
 - * Attempt should be made to ensure that the cyst separated without rupturing or spilling its content

TISSUE RETRIEVAL

- After securing haemostasis, the improvised endobag (sterile latex glove) is folded along its long axis and carefully introduced into the peritoneal cavity with a Maryland forcep
- Within the cavity, the bag is opened and placed in the POD, where the cyst is carefully placed inside the bag
- With the cyst in the bag, a Maryland forcep is used to grab both ends of the opening of the bag and the bag is carefully withdrawn from the cavity along with the Maryland forcep and the port itself (bag is pulled up with the forcep up to the tip of the port, then the port is pulled up a bit and the bag pulled to follow until the port is completely out of the cavity.)
- When the port is out, and the forcep tip bearing the bag is visible outside at the skin

surface, an artery forcep is used to grasp the bag and the Maryland forcep is removed

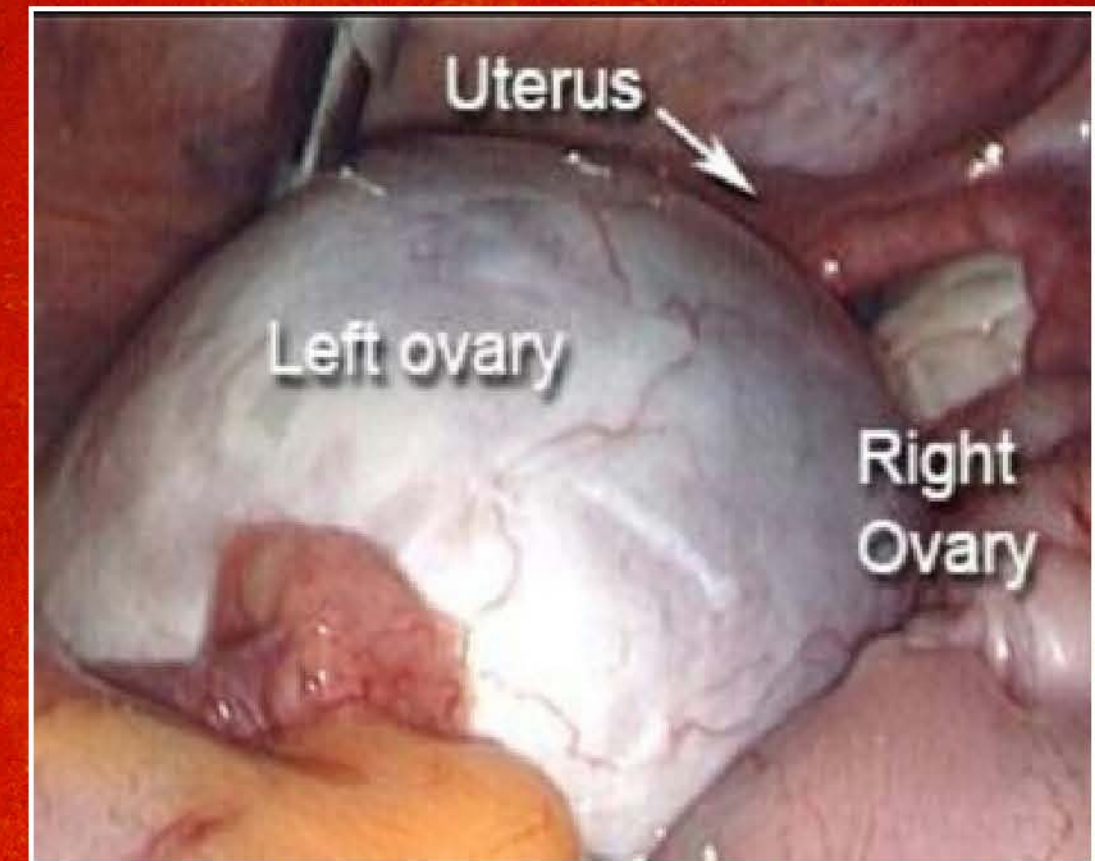
- * The artery forcep is then used to carefully draw out the entire rim of the opening of the bag, which is then held in place
- * Another artery forcep is then used to pick out the cyst from the bag, after which the bag itself is removed and the port carefully replaced

CONCLUSION

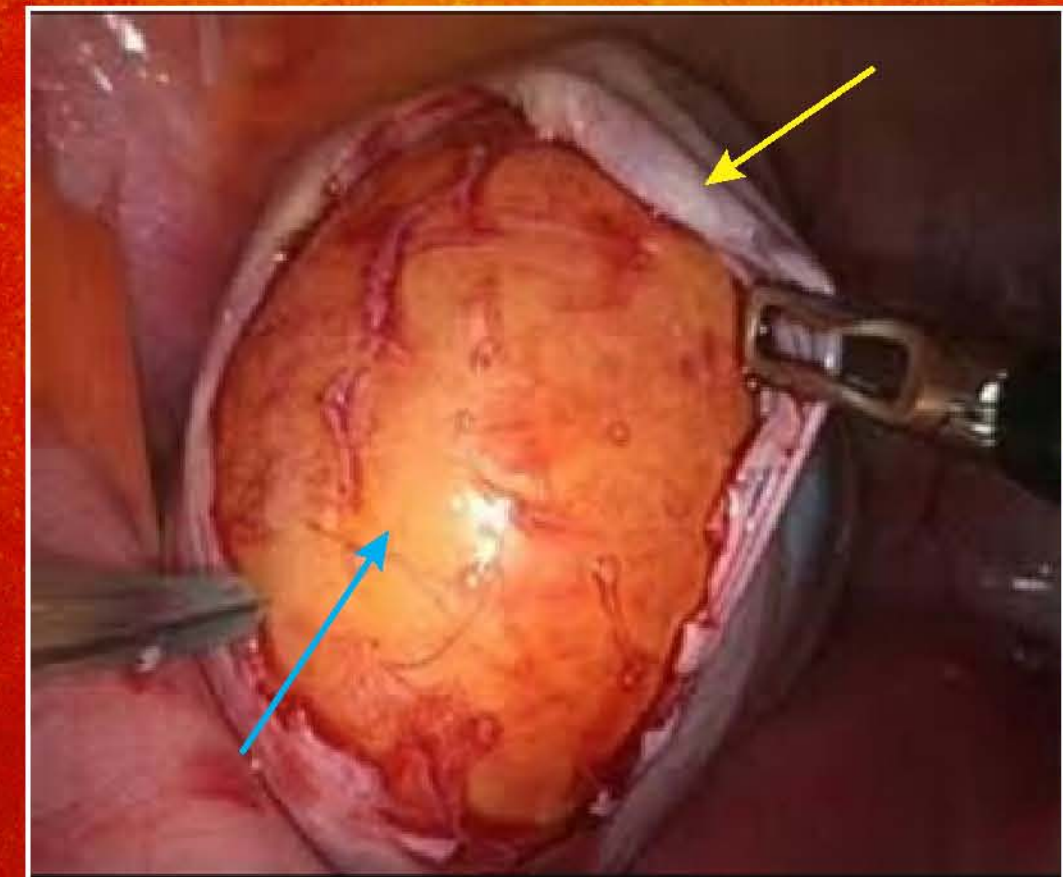
- After replacing the port, the entire peritoneal cavity, especially the ovarian cortex left behind is irrigated properly, and the fluid suctioned from the cavity along with every blood clot

POST-OPERATIVELY

- Where the surgery was performed for an endometrioma, the client should be given at least a start dose of GnRH agonist to help shrink out any endometriotic deposit left behind
 - * SC Zoladex 3.6mg stat OR SC Leuprodex 3.75mg
- The removed cyst is placed in a sealed container with some formaldehyde, labelled appropriately and handed over to the client relative along with a well filled request form for histology



Laparoscopic view of a huge left ovarian cyst



An ongoing laparoscopic ovarian cystectomy. Note the ovarian cortex (yellow arrow) and the intact cyst wall (blue arrow)



INDICATION

- Pedunculated uterine fibroid
- Subserous uterine fibroid which are either solitary or not more than 4 nodules clearly identified on TVS, measuring $>5\text{mm}$ but $\leq 10\text{cm}$
- Intramural uterine fibroid which are either solitary or not more than 4 nodules clearly identified on TVS, measuring $>5\text{mm}$ but $\leq 10\text{cm}$, located close to the endometrium ($<1\text{cm}$ between the fibroid and the endometrium) or causing distortion of the endometrial lining.
- **NOTE:**
 - * Submucous fibroids are better approached via hysteroscopy
 - * Multiple fibroids and huge fibroids are better approached via laparotomy
 - * Myomectomy should be done 3-6 months before undergoing IVF treatment

MATERIALS

- Two secondary ports
 - * One 5mm port
 - * Another 5mm port that could be converted to a 10mm port and used with a 5mm reducer
- Maryland forceps, needle holder and suturing materials
- Claw forceps, knot pushers (bandhaker and Clarks)
- Spatula forcep with monopolar diathermy cable
- Myoma screw, injection needle
- Terlipressin (1g in 10mls), Gardix (5g)
- Morcellator

PROCEDURE

- Carry out diagnostic laparoscopy (Preliminary procedures could be carried out where indicated), observing the uterus for obvious bulges, asymmetry etc. (to identify the fibroid). After which the second secondary port is inserted
- With the spatula, carefully press on the bulge and other surfaces of the uterus to localize the fibroid

- Dilute the 10mls of terlipressin with 90mls of normal saline (making a total solution of 100mls) then carefully inject this solution into the fibroid using the injection needle as appropriate, and wait for about 5mins for the terlipressin to take effect
- The spatula, with coagulative current is then used to make a longitudinal incision on the uterus, over the fibroid to expose it and use a one-actioned forcep (needle holder) to further dissect and expose the fibroid
- A myoma screw is inserted into the fibroid, while the needle holder is used to continually separate the fibroid from the uterus using counter-traction forces
- Where indicated, a claw could also be used to grab on the fibroid while continuous counter-traction force is applied to completely separate the fibroid from the uterus
- After the fibroid has been completely removed, it is carefully placed in the POD
- The myoma bed is then closed with absorbable vicryl-2 suture using any of the tension bearing suturing technique i.e. intracorporal tumble square knot, or intracorporal square knot, or any of the extracorporal knots (pushed with either bandhaker or Clarks knot pusher as appropriate); with dundejamin and Aberdeen termination suturing used to close the serosa layer
- The above steps are repeated for other fibroid nodules present
- **NOTE**
 - * For pedunculated fibroids, simply grab the base of the fibroid with a Maryland forcep and desiccate it by applying coagulative current, after which the pedicle is cut through with scissors

TISSUE RETRIEVAL

- Depending on the size of the fibroid, it could be removed through the port (especially 10mm port) or pulled out together with the port through the incision
- However, if the fibroid is big, then morcellation needs to be done
 - * The skin incision is extended to accommodate the 12mm size of the morcellator which is then coupled properly and into the peritoneal cavity with the aid of its trocar
 - * The morcellator forcep is then passed through the morcellator into the

peritoneal cavity, used to pick fibroid and pull it towards the blades of the morcellator (which would cut through the fibroid creating a piece that would be pulled out by the forcep through the morcellator lumen)

- Before morcellating, hold the morcellator with the fibroid at the blade suspended in the peritoneal cavity so as not to accidentally morcellate other structures

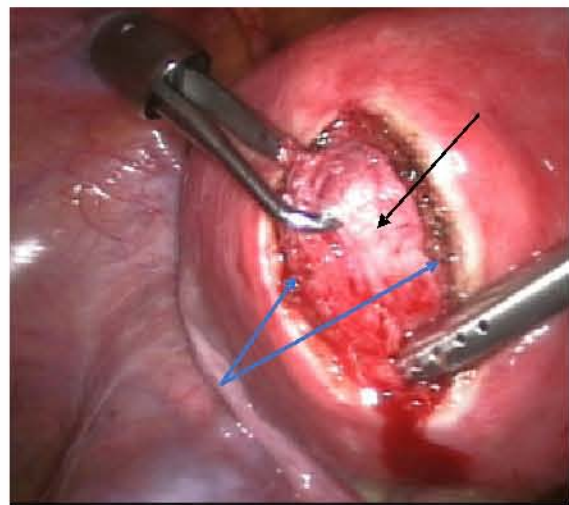
- * This process is repeated until all the fibroid has been brought out of the cavity

CONCLUSION

- After complete removal of all the fibroid, the peritoneal cavity is irrigated (especially the uterine surface), and the fluid is suctioned
- After complete suctioning, the gardix is then introduced through the injection needle and applied over the sutured surface of the uterus (to minimize adhesion formation)

POST-OPERATIVELY

- The morcellated fibroid is placed in a sealed container with some formaldehyde, labelled appropriately and handed over to the client relative along with a well filled request form for histology



An ongoing laparoscopic myomectomy. Note the fibroid (black arrow) as it is being separated from the normal uterine wall (blue arrow)



Laparoscopic myomectomy after complete removal of the fibroid and suturing of the myoma bed

Hysteroscopic Adhesiolysis

INDICATION

- Intracervical adhesions
- Intrauterine adhesions

MATERIAL

- Working element with a resectoscope
- Grasping/biopsy forceps

PROCEDURE

- Carry out thorough diagnostic hysteroscopy, from the cervical canal to the uterine cavity, and identify the tubal ostia while noting
 - * Areas of normal endometrium which appear hyperaemic
 - * Areas of fibrosis/adhesion which appear whitish and firmly adherent (as opposed to endometrial flakes which are whitish, but float freely within the cavity)
- After identifying the areas with adhesion, adhesiolysis is carried out using either the resectoscope or the biopsy forceps
 - * The resectoscope is carefully pushed into the cavity to visualize it, then carefully use it to scrap over the adhesion by pulling towards self while applying coagulative current. This helps to peel off the adhesion (especially for severe adhesions)
 - * The biopsy forcep is used to grasp and pull adhesion to remove them from the endometrial lining
- After completing the adhesiolysis, the cervix and uterine cavity is re-assessed for any areas left out; when satisfied with the observation, the working element is removed and uncoupled
- An IUCD or a paediatric Foley's catheter could then be inserted into the uterine cavity (the balloon of the catheter is inflated and left in place)

POST-OPERATIVELY

- Client is placed on progynova-primolut combination, along with analgesic and antibiotics ±steroids
- Where intrauterine Foley's catheter is inserted, the catheter is left insitu for 10 days, after which it will be removed



One of our IVF babies delivered in Miami, Florida, USA

The goal of all approach to the management of the infertile couple is to achieve the delivery of a healthy baby to a healthy and happy couple thus completing the family as a happy unit.

The UITH ART unit have been able to achieve this said goal for several couples using all the outlined protocols in this text over the years since its inception.

Congratulations to the hospital management, member of the IVF Team and every family that has benefitted from this project in UITH.

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Dr. Michael Osahumen Orhue (Scribe)
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