19 The surgery of conception

19.1 Maternal mortality

Over half a million women died in 2005 of pregnancy, 99% being in low and middle-income countries.

The chances of this happening depend on how often a woman becomes pregnant, and how dangerous each pregnancy is, as measured by the maternal mortality ratio (MMR). This is the number of maternal deaths during a given time period expressed per 100,000 live births during the same time period.

A maternal death is: '*The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes'.* International Classification of Diseases (ICD-10)

In 2013 the global MMR was 289. In sub-Saharan Africa (population 950 million) 180,000 women died of a pregnancy, in Southern Asia 60,000 and in Western Europe and North America (population 800 million) only 1000.

The MMR includes direct causes (ectopic gestation, uterine rupture, septic induced abortion, bleeding after delivery) and indirect causes (malaria, HIV, TB, severe anaemia) but excludes accidental causes (*e.g.* car smash while shopping, but includes a crash with an ambulance during referral for complications in pregnancy. It excludes incidental causes (*e.g.* poisoned by mother in law, suicide); although these deaths could be related to the pregnancies, they are kept out of the definition.

To facilitate the identification of maternal deaths in circumstances in which cause-of-death attribution is inadequate, ICD-10 introduced an additional category, **pregnancy-related death**, which is defined as the death of a woman while pregnant or within 42days of termination of pregnancy, irrespective of the cause of death.

If official death registration forms could have one extra question: "Was the deceased pregnant or within 6wks of a pregnancy when she died", then the collection of this data would be much easier in many countries.

Another useful statistic is the **Lifetime risk of maternal death**: this is the probability of maternal death during a woman's reproductive life, usually expressed in terms of odds: these were, in 2013,

   Afghanistan and Sierra Leone, $^1/_6$
   Sub-Saharan Africa, $^1/_{16}$
   Northern Europe, $^1/_{25000}$

The causes of maternal mortality (MM) in sub-Saharan Africa, which broadly reflects the situation elsewhere in the developing world are:

(1) Haemorrhage	35%
(2) Sepsis/infections	10%
(3) Hypertensive disorders	10%
(4) HIV/AIDS	6%
(5) Abortion (mostly induced)	4%
(6) Obstructed labour	4%
(7) Anaemia	4%
(8) Embolism	2%
(9) Other indirect causes	17%
(10) Other direct causes	5%
(Unclassified	*3%)*

N.B Regarding (4): An HIV+ve woman has a 4-5 times higher chance of dying in pregnancy than a HIV-ve woman. The extra MMR related to HIV was 1300. HIV infection in pregnancy increases the risk of obstetric complications. HIV-related illness such as anaemia or tuberculosis might be aggravated by pregnancy. The quality of care received by women who are known HIV+ve might also be worse than that received by other women. There is no good evidence that HIV disease progresses faster because of pregnancy. Biological changes are probably responsible for the fact that women are twice as easily infected by HIV when pregnant. Existing programmes to prevent mother-to-child transmission need also to inform HIV-ve women about the increased risks of acquiring HIV if they fall pregnant.

Regarding (5): This might be an underestimation. The WHO systematic review estimates an MMR from induced abortion as 37 in sub-Saharan Africa, 12 in South Asia, and 23 in Latin America. However, much higher estimates have been reported globally and in individual studies, especially in countries where abortion is illegal.

Regarding (10): This includes ectopic gestation, for example.

Where and when do women die.

Maternal deaths happen in <50% cases at home. This is likely to be higher in Islamic countries but figures are hard to come by. Most die in a health institution where they might have arrived moribund. Much dying also happens *en route*. Most die on the day of delivery or in the next few days. However, the theoretical lowering of MM by living in town can be easily nullified by a higher incidence of unsafe abortion and of HIV. An academic hospital will not be very effective in this respect if most of the work is done by unsupervised junior doctors; a district hospital may often then be a safer place to deliver! As indicated previously (1.5), delays play a very important rôle in the failure of women being able to seek medical attention.

The 1st potential delay is the recognition by women and their relatives of the need for medical help. The 2nd delay relates to physical, cultural, and financial constraints as well as the security situation. The third delay relates to the time needed to organise and pay for the actual medical care.

Room for Improvement

Latin-America and North Africa have improved their MMR figures impressively. There seems to be little progress in sub-Saharan Africa. Income is an important factor between and within countries but does not explain all the differences. For example, people in Sri Lanka, Vietnam, Ecuador, and Ghana have similar purchasing power. Their estimates of MMR are respectively 29, 49, 87, 380. Countries such as the Netherlands, Sweden and Denmark had MMRs of 300-350 a century ago, mainly because of the presence of many well trained midwives. The USA only caught up (in 1935 the MMR was around 600) when there were enough doctors to provide maternity care.

The MMR varies widely as seen above. It used to be high all over the world. History shows how often kings lost their queens in childbirth. The natural MMR, which means no medical interference whatsoever, is around 1,600. In some communities in Africa and Afghanistan it is still 1,000 or more, which means that a mother has around a 1:100 chance of dying from pregnancy-related causes/per pregnancy, or a 1 in 14 chance in her lifetime, if she has 7 pregnancies. The result is that a woman living in a remote area of Afghanistan has a 1,000 times greater lifetime chance of dying of a pregnancy than a woman in Scandinavia. The MMR in high-income countries makes almost no impact on the global MMR. One of the problems apart from war is that in certain countries, authorities discourage (higher) schooling of women, as was the case in Europe 100 years ago, and male doctors are forbidden to attend to pregnancies, as in Europe 400 years ago.

The deaths of mothers are more difficult to prevent than those of their children, because a good basically equipped hospital with well trained staff is needed. On the other hand, reducing infant and under-five mortality by means of vaccinations, provision of clean water, improved nutrition is less of a technical problem. However even though the successful building a district hospital, including its staffing and transport access, results often in good outcomes from high-risk pregnancies of women staying in the shelters nearby, the low-risk pregnancies which still can have unexpected complications do badly because women arrive in hospital too late. This is related usually to traditional customs and beliefs. Organising a 'bed & breakfast' industry for all women in the last 6wks of their pregnancy near every good district hospital might prevent much misery. Something else which should be easy is providing for the unmet need for contraceptives. You only need staff, dedication and the right contraceptives (for which donors are easy to find). Half of the pregnancies in the world are unintentional. To prevent these would halve the number of women who die of pregnancy. On a global scale this has already happened: in 1950 the TFR (total fertility rate, or average number of children a woman bears) was 5; recently it has become 2·5. This is of course not represented by the MMR because this refers to how dangerous each pregnancy is. Nonetheless, in absolute numbers, it makes a big difference. Furthermore, the MMR is likely to go down because high risk pregnancies will decrease when contraceptives are widely available.

There will be more health workers per delivery and the economic benefits are likely to increase the budget for the Ministries of Health and Education. Educated women are far less likely to die of a pregnancy.

Women who die often have not had antenatal care (ANC); they are 'unbooked' and they are seen often late when there are problems. ANC detects some problems in time (anaemia, syphilis/HIV/malaria infection, breech presentation, high blood pressure, severe growth retardation) and makes it possible to discuss a plan: "Are you going to stay with your cousin near the hospital? What will you do if your membranes rupture too early? What transport options exist at various times of the month/week/day? How can we prevent the next potentially dangerous pregnancy? Do you wish for and are you ready for sterilization?"

Saving pregnant women is *not* basically a question of having beautiful machines, laboratories and computer. In North Western Europe before the Second World War (1939-1945), the perinatal and maternal mortality rates were better than they are in many large African hospitals now. At that time the Caesarean Section rate was <1%. There were no antibiotics, modern anaesthetics, safe blood transfusions, vacuum extractors, reliable IV oxytocin, anti-D and anti-tetanus injections, prostaglandins, contraceptives other than condoms, cardiotocographs, ultrasound, or Doppler machines, or modern suture materials. There was little evidence-based knowledge. Polio, rachitis (severe pelvic deformity due to vitamin D deficiency) and (then untreatable) syphilis were common. The difference was that the facilities were provided and there were enough staff. They received reasonable salaries and pensions. The exodus of staff for more lucrative jobs was rare and they were revered for identifying with the suffering of their own people. So encourage such staff, and do what you can to improve their working conditions!

Never in history has a doctor, prepared to work in a rural district hospital, had so much opportunity to save lives. Saving their lives requires also improved education for women and services at 3 levels: in the community, in clinics and health centres, and in basically equipped and staffed district hospitals. Especially, it needs plenty of well-trained midwives. The midwives alone made the first large dent in the MMR in Europe. Furthermore non-doctors are easier to retain. A study from Mozambique showed that over 7yrs 88% of the medical assistants were still working in the rural areas but *NONE* of the doctors! Changing maternal mortality needs political will. To raise this you will need to know your local/regional MMR. To get an idea, ask adults what happened to their adult sisters and whether or not they died in childbirth. Their mortality experience will be a measure of that of the community as a whole.

A simple way in LMICs to monitor the very basic quality of obstetric care and associated transport facilities is recording everywhere the vesico-vaginal fistula (VVF) rate. These are easier to prevent and record than MM. Women with VVFs are very likely to present at some stage at a health facility. All VVFs with all details of the identity of the woman involved and date and place of delivery, transport bottlenecks and so on should be sent once a year to the Ministry of Health. At that level duplicate recording of women can be sorted out and an annual VVF report made. This might be a very sensitive indicator of the year on year difference in quality of obstetrical care. VVFs caused by obstructed labour (not those made at Caesarean Section) happen only when women have been in labour for >2days. It could also show very well, for example, that an increase in the price of fuel results in more VVFs.

19.2 Obstetric aims & priorities

Between 5-10% of the babies of LMIC mothers die in the perinatal period (from 28wks of pregnancy to 7days after delivery), frequently related to the development of the placenta. Preventable causes include malaria, syphilis, and obstructed labour. Most perinatal deaths are of normally formed, normal weight babies who die avoidably from trauma, asphyxia, or infection. Statistics show that perinatal mortality decreases with the number of weeks of pregnancy. At around 36wks this trend reverses because mechanical factors, especially cephalo-pelvic disproportion (CPD), is now playing an increasing role while these deaths are, in theory, all preventable.

Many neonatal deaths also occur in babies whose low birthweight is due to their being born too soon (prematurity), or to not having grown normally before birth (intrauterine growth retardation: IUGR). If a mother dies, the baby will also, even if it is born alive in a good condition. The baby will also often die without the breast milk and the special attention which is nearly unique to the biological mother. The deaths of both mothers and babies are largely due to the material, political, and socio-economic conditions and traditions under which they live. Here we are concerned with obstetric causes of death.

Despite the challenges of pregnancy and childbirth, an important task in many communities is to reduce the frequency with which pregnancy occurs. Most governments are in theory convinced that proper development cannot be combined with women having many children. The problem is often that governments have many tasks and not enough resources. Facilitating free access to **family planning**, however, is a task governments often do not see as a priority because there may be stiff opposition from various quarters. Reducing unwanted pregnancies will decrease the need to keep on building new schools, hospitals, universities, create jobs and to import food.

Populations especially in Africa and the Far East, and to a lesser extent elsewhere, are growing so fast that they are causing acute pressure on land, on food, on the wood (to cook the food), on jobs, on education, and on the health and other social services.

In some areas this population pressure is already finding its expression in desertification and starvation, in abject poverty, people risking their lives trying to flee to Europe and the US and in civil disorder. The slaughter in Rwanda, but also the Second World War, stimulated by the German call for *Lebensraum* (space for living), were clearly related to deemed population pressure. The population in Rwanda has since increased again to the previous level. Your own community may not have reached this point yet, but is it already exerting such pressure on its environment that 'ecological collapse' is not far away? If it occurs your community may become 'ecological refugees', if indeed there is anywhere to flee to. If birth rates don't fall, death rates may rise to their old values (of 100 years ago) or higher, with a much larger population in a much impoverished environment.

This is described as the **demographic trap**. Europe solved its population pressure problems in the past by colonization. The result is that half the people of European stock live in the 'New Worlds', where they drove away or killed the indigenous peoples. Africa and the Middle East do not seem to have that option. China, South Korea, Thailand, Singapore, and Sri Lanka have shown that limiting population increase can allow for enormous economical boost, resulting in a rise in the standard of living. This rise is not, however, without problems because of risks of gender number inequality, where boys are valued more than girls, who are therefore eliminated. Increasing population also brings pollution, and land degradation. The chance for all the people in the world to have a reasonable standard of living becomes more remote if the world population keeps on increasing as the rate it has done recently (1 billion people extra every 15yrs) despite HIV disease. If everybody has 2 children only, there might just be enough food globally if it is equally distributed. If everybody has 4 children, such equal distribution will not help. The rich must adjust their standard of living, reduce their waste and the poor should have fewer children. But without reduction in child mortality, women will still want many children as an insurance for the future. Many politicians also believe that a large population is important because it makes a country powerful. But Sweden (7million) has probably more influence than Bangladesh (145million). If China had not had a population policy, they would have had 350million more people and the Chinese would be not such an economic threat to the US as they are today. They would probably be begging for food aid.

Because so much obstetrics must be delegated, the instruction and supervision of those to whom you delegate it is critical. Some mothers will be delivered in hospital, and some by midwives in health centres. Most of them will probably be delivered at home, attended either by their families, or by traditional birth attendants (TBAs), such as the *dais* of India. A study from Burkina Faso showed that active encouragement from the local chiefs increased the deliveries in health institutions from 25 to 56%.

Another way to reduce the maternal and perinatal mortality in your district may be to start with the TBAs, to concern yourself with what they do, and to instruct them where you can. If a specialist group of TBAs are at work in your area, each of whom delivers several mothers every year, try to run training courses for them.

For example, as the main cause by far for maternal mortality outside hospital is post-partum haemorrhage (PPH) you might for example start a programme in which TBAs are provided Misoprostol x3 tablets (600µg) to dispense orally directly after the baby is born (if not a twin).
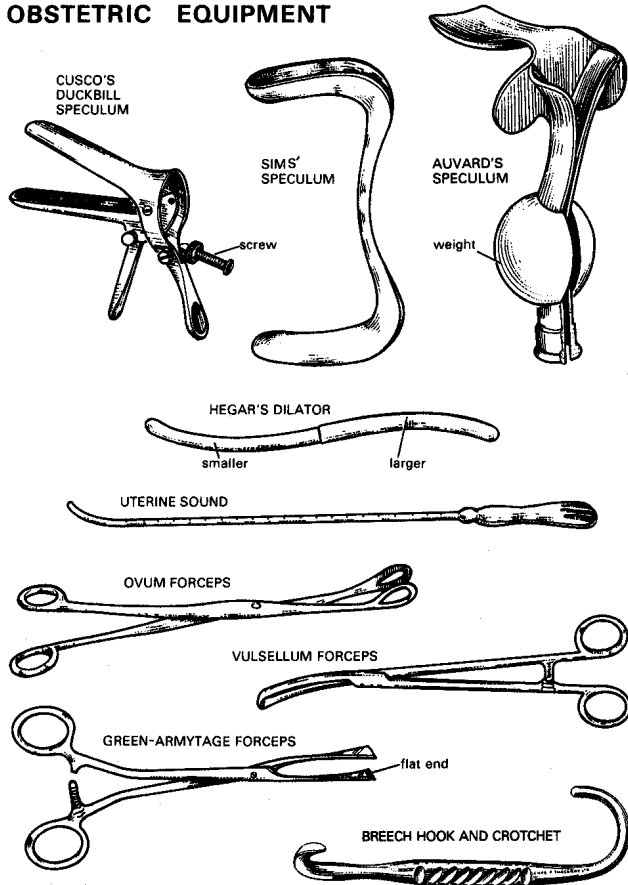
OBSTETRIC EQUIPMENT

Fig. 19-1 SOME OF THE EQUIPMENT you will need.

STETHOSCOPE foetal, plastic. These don't bend so easily as aluminium stethoscopes.

DOPPLER FOETAL HEART DETECTOR, 'Sonicaid' pattern or equivalent. This is comparatively inexpensive (about $250) and very useful.

PORTABLE ULTRASOUND. This is so useful that you should really try to get one.

SPECULUM, *vaginal, Sims', double-ended, medium size, 27-30mm.*

SPECULUM, *vaginal, Cusco's, duckbill, small and large, stainless steel.* These specula open like the beak of a duck, and in doing so enable you to examine the cervix.

SPECULUM, vaginal, weighted, Auvard's, chromium-plated. The weight on this speculum presses it downwards, and so keeps the vagina open.

FORCEPS, uterine vulsellum, curved, 1-2 teeth and 3-4 teeth, box joint, 230 mm. Use these to grasp the cervix when you curette it.

FORCEPS, Post partum ring (sponge) are better to grasp the cervix.

DILATORS, cervix, double-ended, Hegar's set of 12 sizes, 1/2mm to 23/24mm. Use these to dilate the cervix before curetting it.

MANIPULATOR, uterine. Use this to bring the uterine fundus up against the abdominal wall when you perform a mini-laparotomy.

SOUND, uterine, malleable, metric, graduated shaft. Use this to measure the depth of the uterus before inserting an intra-uterine device (IUD) or a small suction curette in post-menopausal bleeding (PMB). A sound is a dangerous instrument in a recently pregnant uterus, because you can easily perforate it.

RETRACTORS, Langenbeck (large). Useful as well for a mini-laparotomy

FORCEPS, Babcock (small). Use these to grasp a Fallopian tube while performing a tubal ligation or operating for an ectopic gestation.

FORCEPS, ovum, curved, screw joint, McClintock 250mm. Use this to remove the products of conception from an incomplete miscarriage, after you have dilated the cervix. If you don't have them, use sponge-holding forceps.

CURETTE, uterine, double-ended, blunt and sharp, 8mm & 5mm. The great danger with a curette is that you may push it through the wall of the uterus, especially a recently pregnant uterus. Let a curette lie gently in your fingers, so that you can feel the wall of the uterus: don't grasp it firmly.

CURETTE, suction, stainless steel, reusable, sizes 8 and 10 Hegar. Use this for evacuating a hydatidiform mole (it causes much less bleeding than dilatation and non-suction curettage), and for terminating a pregnancy which has lasted <12wks.

KARMAN'S CANNULA, Plastic, size 4-12mm. These are better than a curette. Use small sizes for dysfunctional uterine bleeding (DUB, 23.3) or PMB, and larger sizes for retained pieces of placenta of 22-42wks, or a very large molar pregnancy). The in-between sizes are very useful for removing retained products of conception from the uterus, best with the help of an electrical suction machine.

CURETTE AND SYRINGE for manual vacuum aspiration (MVA), sterile, plastic, disposable (but boilable though not autoclavable). They are also very useful for non-septic incomplete miscarriages seen at the out-patient department if there is no suction machine there.

CANNULA, cervical, Leech Wilkinson or Miller. This is for doing a hystero-salpingogram (HSG: 38.1).

SCISSORS, episiotomy, Vant. These have straight blades and round points.

VACUUM EXTRACTOR (VE), Bird's modification of Malmstrom's, complete with 3 suction cups 40, 50, 60mm, one posterior cup, traction handle, vacuum hand pump, chain, spare vacuum bottle and spare baskets. Bird's modification is better than the original Malmstrom extractor, and is quicker and easier to assemble. The anterior and posterior cups are not absolutely necessary. An expensive disposable KIWI will give you a luxurious feeling but the old-fashioned well-maintained Bird's is good enough. You need several sets of cups and tubes because you should be able to do 2-6 vaginal examinations in a weekend. Good simple maintenance of this basic equipment can make the difference between life and death for mothers and babies.

FORCEPS, outlet, Wrigley. Outlet forceps are the only safe ones for anyone but an experienced obstetrician. Even then becoming a master with the vacuum extractor is easier and better.

FORCEPS, haemostatic, straight, Green-Armytage, 203 mm. Use these for clamping the (digitally) cut edges of the uterus during a Caesarean Section (the faster you become the less you need them), and for repairing a ruptured uterus.

STURDY FOLEY'S CATHETER with balloon content >25ml. Use this to deliver a <u>dead</u> breech presentation (21.8). Introduce the catheter *via* the foetal rectum, inflate the balloon and then traction is very easy.

PERFORATOR, Simpson's. This is the standard instrument for opening the skull when doing a destructive operation. If these are not available, Kochers forceps (large, straight or curved) will also do, or even large artery forceps.

RETRACTOR, Doyen's. Use this for Caesarean Section, it has a curved lip which fits over the lower end of the wound and keeps the bladder out of the way of the operation.

RETRACTOR, Kirschner. This gives an excellent exposure for laparotomy, with a good view for operating in the pelvis.

SAW, decapitation, Blond-Heidler, complete with ring, thimble and blades. Use this for decapitating a dead baby when labour is obstructed by a transverse lie. It is a piece of wire with teeth on it, hooks at each end to fit handles, and pieces of tubing to prevent it from cutting his mother. It also has a thimble you can push round his neck to fix the saw.

SCISSORS, embryotomy, Queen Charlotte's pattern. Use these scissors, which were specifically designed for destructive operations, if you do not have a saw.

19.3 Infertility

Infertility causes much distress, particularly in those districts of Africa where true incidence is unknown, and the subject is surrounded by much taboo. Some 30% of women aged 25-49yrs suffer from secondary infertility (failure to conceive after the first pregnancy). You may decide in your district hospital that you have other priorities, and that infertility investigation and treatment is so unrewarding that you are not going to try. If you do decide to assist, make it part of your family planning activities and *promote an integrated 'fertility service', which is concerned with both too much and too little fertility.*

N.B. Couples with HIV infection are more likely to suffer from infertility. Reasonably, this, like other STIs, needs treatment first.

During a normal menstrual cycle, between a couple staying together where the woman is ≤32yrs, there should be a 25% chance of pregnancy when sex is ideally timed. This percentage drops as the woman becomes older. After 1yr of normal sexual intercourse on random days, a couple should conceive. However, this data is based on statistical probability and may not apply in the individual case. Nonetheless, in normal circumstances, it is reasonable to start investigations after 1yr. *You must start with the husband! Always enquire about previous pregnancies!*

Take a sexual and menstrual history. If the woman has regular cycles, she is almost certainly (95%) ovulating. Failure to ovulate is typically associated with irregular cycles (normal cycles are 25-35 days long) or amenorrhoea. An irregular cycle will, however, in 75% still be associated with ovulation. If you are not sure, you can ask her to keep a temperature chart. She may be sufficiently educated and motivated to do this, particularly if she is a member of the hospital staff or a teacher. A sustained 0·4ºC temperature rise for 14days before the start of menstruation is good evidence that she is ovulating; if the rise continues she might very well be pregnant. Absence of this rise, especially if her periods are irregular or scanty, is reasonable evidence that she is not ovulating. This test will of course not work if she has a pyrexial illness including malaria, TB or HIV.

Otherwise you can:
(1) Perform a post-coital examination: examine the mucus from inside the cervix.

N.B. With clomiphene treatment, especially in high doses, later than day 7 of the cycle, this test is not reliable.
(2) Perform a uterine curettage during the second half of the cycle, or better, the 1st day of the period and send the scrapings for histology.
(3) Examine the ovaries laparoscopically (19.5) to see if they have a corpus luteum with a scar (stigma), showing that ovulation has occurred. At the same time, test the patency of the tubes, by injecting blue dye though the cervix, and seeing if it appears in the peritoneal cavity.
(4) With vaginal ultrasound, easily follow a follicle in growth and disappearance.

(5) Measure progesterone: a high level 1wk after the presumed ovulation more or less proves it has occurred.
(6) Check urine luteinizing hormone (LH) levels daily using commercially available test kits at the time of an expected ovulation. An LH peak predicts an ovulation within 1 (35%) - 2 (60%) days.

You can classify anovulation into 4 groups:

Group; Frequency (%)	FSH level	Oestrogens	Abnormality	Therapy (Pregnancy chance %)
1.Hypogonadotropic 10%	Low	Low	Hypothalamic -pituitary	Pulsatile gonadotropin release hormone (80%) or gonadotropins
2.Normogonadotropic 75%	Nor-mal	Normal	Hypothalamic -pituitary-ovarian	Clomiphene (50%), weight optimization (20%), gonadotropins
3.Hypergonadotropic 10%	High	Low	Ovary	None
4.Hyperprolactinaemic 5%	Low	Low	Pituitary	Bromocriptine/ cabergoline (65%)

N.B. You will probably not be able to treat women in groups 1&3, but it is nevertheless a good idea to advise the contraceptive pill (for growth/maintenance of the breasts, to prevent osteoporosis and to have monthly periods if they so wish). *Remember the side-effects of the contraceptive, though!*

Clomiphene is only indicated for anovulatory infertility. Warn of the increased incidence of multiple pregnancies. The dose is 50mg od from the 3rd-7th day of the menstrual cycle, or at any time if cycles have stopped, to a maximum of 12 courses. Monitor ovulation with a temperature chart. If she does not ovulate, increase the dose by 50mg amounts each month, to a maximum of 200mg od for 5days.

N.B. CAUTION with CLOMIPHENE!
(1) *Only use clomiphene to HIV-ve women with patent Fallopian tubes and fertile husbands. Don't use it randomly on all infertile patients.*
(2) It is contraindicated in hepatic disease, ovarian cysts, pregnancy, and abnormal uterine bleeding.
(3) Side-effects include visual disturbances, hot flushes, nausea, vomiting, depression, insomnia, breast tenderness, weight gain, rashes, dizziness and hair loss. It may make the ovaries tender and temporary cystic, and can simulate an acute abdomen

Ideally only if your laboratory can determine prolactin levels should you treat with bromocriptine.

The combination of lactorrhoea, amenorrhoea and infertility might, when prolactin testing is unavailable, prompt you to try bromocriptine 2·5mg od.

Gonadotropins have no place in district gynaecology.

Typically, about 60% of infertility is caused by adhesions and **blocked Fallopian tubes** that follow PID or perhaps a septic miscarriage, tuberculosis (especially if HIV+ve) or rarely schistosomiasis. Occasionally a woman is sterile as the result of tuberculous endometritis; sterility is its most common presentation.

Anti-TB medication is unlikely to make her fertile; she has c.8% chance of conception, but only 2% chance of a live child. She also runs an increased chance of an ectopic gestation.

Sometimes, you can make the diagnoses by histology from D&C scrapings on the 1st day of her period, or by seeing miliary TB at laparoscopy or laparotomy.

Repairing tubes that are blocked is an expert's task, and even then the success rate is low, so you may decide that there is little point in investigating these patients if they cannot be reliably referred. But sometimes it is very easy to open Fallopian tubes which are only closed at the distal end (like phimosis) using blunt small artery forceps. If *fimbriae* are then visible and the tube can be kept open by a few very small atraumatic nylon sutures, the prognosis is not that bad. *You must then warn about the symptoms and signs of an ectopic gestation.*

If you suspect blocked tubes, you can:
(1) Perform a hysterosalpingogram (HSG, 38.1l) which will tell you where a block starts and sometimes about a fibroid in the uterine cavity. This investigation is time-consuming and expensive, though.
(2) Insufflate the tubes, which is cheaper, but gives less reliable information. Also, the instrument can leak, and you can make mistakes.
(3) Perform a laparoscopy which again is expensive and time-consuming.

Fibroids (23.7) can be the cause of infertility especially if situated in the uterine cavity or when compressing the tubes in the cornua. *More often fibroids are the result of infertility.* Typically though, a woman with infertility and fibroids is also found to have blocked tubes or an infertile husband. Sometimes large or many fibroids cause repeated miscarriages and should be (partly) removed.

You might succeed by removing the largest most distorting and other easily accessible pediculated fibroids, but you might also cause many adhesions which will subsequently interfere with fertility. Careful operating, keeping tissues moist, no rough swabbing, and closing the pelvic peritoneum will reduce such adhesions. Try to remove several fibroids through the same incision, and avoid wounds on the posterior surface of the uterus.

IN MEN:
Examine the seminal fluid within 2hrs of production. It is normal if: it has a volume of 2-6ml, it is liquid >30mins, it has 60% of motile sperms, and it has ≥20million sperms/ml, <15% being abnormal.

If there is a low sperm count, suggest abstinence from sexual intercourse until the 12th-14th day of the woman's cycle. Tight nylon underwear or other exposure to heat (*e.g.* sitting often on the engine of a truck, working in a bakery) and heavy smoking may be causes. Suggest loose cotton boxer shorts.

If there are pus cells in the ejaculate, treat the infection and of course his partner's. It can take 3months after successful treatment before the sperm count improves.

Some men refuse to cooperate. Often the woman is not responsible, but she may well be sent away by the man if a pregnancy does not appear.

The history is very important. If a woman is now with her 3rd partner and has had no children at all, it is unlikely that the man's semen is the problem, especially if he has children with other partners. Beware, though, of vague stories of men who say they have a child in a town 400km away! Sometimes these stories are backed up by his family to spare the man embarrassment.

THE POST-COITAL TEST will help if the husband refuses to cooperate or if your laboratory cannot do proper semen analysis. It also gives extra information about the quality around the ovulation of the cervical mucus (sticky, clear, elastic up to 6-8 cm) and will also confirm that semen has been deposited in the right place!

Timing is very important. Only 1-3days around the time of the ovulation (if present) do sperms enter the cervix and swim to the tubes; they may survive in the cervix for quite some time (2-3days). It is satisfactory to examine the cervical mucus the morning after evening sexual intercourse.

Expose the cervix, use a syringe (without needle) to suck some mucus from *inside* the cervical canal, put it on a microscope glass (not easy as it will tend to adhere to the syringe but the cover glass might help trapping the mucus). Examine under the microscope with 10x10 magnification. Progressively mobile sperms will more or less exclude a male factor, hostile cervical mucus (a rare cause for infertility), and a faulty sexual technique. If the test is -ve repeat it, try if necessary, on consecutive days to catch the ovulation.

   N.B. In some cultures it is accepted that a woman becomes impregnated secretly by a male relative of the husband, if he is azoospermic. *Note the risks of tramsmission of HIV, and other diseases by this practice.*

IN WOMEN:
UTERINE CURETTAGE. (GRADE 1.3)
Don't do this if periods are regular or she is taking the contraceptive pill!
Perform the test very early when her periods start. Preferably use a microcurette, as an outpatient. Otherwise, perform a D&C (23.4). Send half the curettings for histology, indicating the request is for ovulation, and the other half for TB investigation.

TUBAL INSUFFLATION (GRADE 1.4)

INDICATION. Although theoretically simple, false results are not uncommon. If insufflation is the only method of investigation you have, this suggests that expert tubal surgery is unlikely to be available, which should make you question the value of insufflation.

METHOD.
Place the patient in the lithotomy position. Insert the insufflator into the cervix and fill the vaginal canal with fluid, so that the end of the cannula and the cervix is submerged, and you can see if there is a leak. Introduce some carbon dioxide, and listen over the lower abdomen with a stethoscope for the sound of it bubbling out of the tubes. Measure the rise in P_{CO_2} before free flow occurs.
If the tubes are patent, pressure will peak, and flow occur <40mmHg. If they are blocked it may rise as high as 160mmHg. You can also feel the difference with the plunger of the syringe. (If you are using air, use a maximum of 250ml, and do not allow a pressure >100mmHg because of the risk of air embolism.) You might consider using normal saline; if you can inject 20ml easily, at least one tube is open or you might have opened up one tube.

N.B. Ultrasound can detect passage of liquid out of the tubes.

LAPAROSCOPY AND DYE INJECTION (GRADE 2.3)

Under GA, insert a Miller cannula into the cervix. Insert a laparoscope abdominally, as for tubal ligation (19.4), and tilt the head down until you see a good view of the pelvis. If you cannot see clearly, insert a blunt-ended hook in the midline suprapubically, and use this to manipulate the tubes. Alternatively, manipulate the vulsellum forceps (hold it vertical and then push it down) on the cervix to anteflex the uterus and make the tubes visible. Inject 10-20ml of methylene blue dye diluted 1:10 in sterile water *via* the cervix, and look for dye spilling from the ends of the tubes. If blue is not available, water-based *(non-soapy)* betadine will also work but is more difficult to see.
Normal tubes: the *fimbriae* look healthy and the dye spills through easily. It may spill on one side only (least resistance), but if both tubes look healthy, they are probably both patent.
Cornual block: No dye enters the tubes. As your assistant injects the dye, the junction of the tube insertion into the uterus blanches or colours slightly.
Fimbrial block: The tubes are often distended; their *fimbriae* are clubbed and sealed over the ostia, and may be adherent to the ovaries. As you inject the dye, the thin walls of the tubes allow you to see it entering them. Usually, no dye spills out. Sometimes the fimbrial block is partial, so that only a little spills.

19.4 Tubal ligation (TL)

This should be one of the most common operations you do and many women and couples will be very grateful for it. Choose it after careful consideration of the alternatives (a copper IUD is good for 8yrs and nearly as effective, a hormone IUD is good for 5yrs and at least as effective but expensive), so your operation must be as safe and as painless as it can be. Try not to keep a mother waiting long for surgery, or she may become pregnant meanwhile!

Large numbers of mothers would like their tubes tied, and if you take the trouble to encourage them, many will be willing to accept it. But however many ligations you do, you will probably be only able to satisfy a small fraction of the community's need.

You can:
(1) Tie a woman's tubes at the same time that you perform a Caesarean Section (21.9).
(2) Perform a 'mini-laparotomy', which is a laparotomy through a very small incision.
(3) Occlude the tubes through a laparoscope.

Tying the tubes immediately after delivery (and to some extent after a miscarriage) has several advantages:
(1) They are easier to access when the uterus is still enlarged.
(2) The patient will already be in hospital, whereas if you discharge her and ask her to come back, she may never return.
(3) Immediately after a normal delivery/miscarriage she will tolerate the minimal additional trauma of sterilization particularly well.
(4) If you have already opened the abdomen for some other reason, including Caesarean Section (or perforation after a backstreet abortion), tying the tubes is easy.

There are, however, some minor disadvantages in doing it at this time: (a) She may change her mind later, though in practice this is rare. (b) You may have not been able to exclude a serious abnormality in the newborn beforehand.
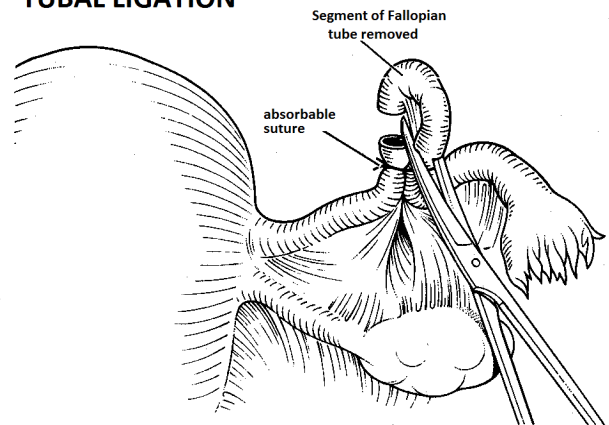
TUBAL LIGATION

Fig. 19-2 TUBAL LIGATION.
Tie a loop of Fallopian tube and excise it. You can also use rings and clips.

INDICATIONS:
(1) Mothers who are sure they want no more babies.
(2) Medical diseases making pregnancy dangerous, particularly severe heart disease, renal failure, HIV disease or severe diabetes.
(3) Previous Caesarean Section where another Caesarean Section would be impossible to organize.
(4) Ectopic gestation in a multipara.
(5) Severe psychiatric disease.

CONTRAINDICATIONS.
(1) Extreme obesity.
(2) Excessive anxiety.
(3) A history of PID causing severe adhesions to the uterus of a patient not in the immediate post-partum period.
(4) Infertility.
(5) Pregnancy.
(6) Refusal to give consent.

CAUTION! Informed consent is essential, but does not usually legally need the agreement of the husband, although in some cultures leaving the husband out of the equation is unacceptable. Obviously it is better to discuss the option of TL early in pregnancy, but this does not mean you cannot introduce the subject during labour (especially if you have had no other opportunity) especially if you plan a Caesarean Section.

A solution is to have a pre-printed area on every antenatal clinic card where nurses or midwives could record early in the pregnancy, "wishes for a TL". This is especially important for a woman >30yrs who is para >2.

If a woman is enthusiastic at once and she knows what you are talking about, it is patronising not to let her make use of the opportunity. Indeed, if you have to perform an emergency Caesarean Section, *e.g.* for failure to progress in a para 4 woman who presented late in hospital but you deliver a well baby, it is quite possible that any subsequent regret to consent to TL is far outweighed by the chance of death in the next pregnancy (from uterine rupture, *placenta accreta*, haemorrhage during a difficult Caesarean Section etc.).

In fact, most multipara regret not having been given the option of TL at Caesarean Section. If in doubt, women will choose not to have a TL. There is no proof that women in Africa choose recklessly in favour of a TL.

DUDUZILE, a 40yr old para 7 arrived in shock in the nick of time from a remote area with a bleeding ectopic gestation. A junior doctor operated on her, removed the affected tube but did not tie the other tube; he thought it unethical. When she understood that the next morning, she refused to leave the hospital till the other tube was likewise tied. She remembered her fear of dying and wished never to go through the same ordeal again.
LESSON: After one ectopic gestation with a contralateral tube open, the chance of a further ectopic gestation is as high as 20-30%.

ARRANGEMENTS. It is best to perform TLs on a special operating list, and perform them early, so they are not displaced by other elective operations and emergencies. You may be able to run a 'TL camp' or set up adequate preparations at a Health Centre. Normally intervention under LA, with or without some sedation, is possible.

METHOD. (GRADE 2.3)
Immediately before the operation, ask the patient to pass urine, to prevent you cutting into the distended bladder. *This is important*. Perform a careful bimanual examination to make sure that she is not already pregnant (although you can tie tubes during pregnancy without significant extra risk, to prevent the next pregnancy).

Use the semi-lithotomy position, with the thighs flexed to 45° and moderately abducted, the knees flexed, and the lower legs horizontal. Use Lloyd-Davies stirrups, or the cheaper 'Chogoria' supports (19-3). Make sure you can put her in a head-down tilt and that she does not slide off the table!
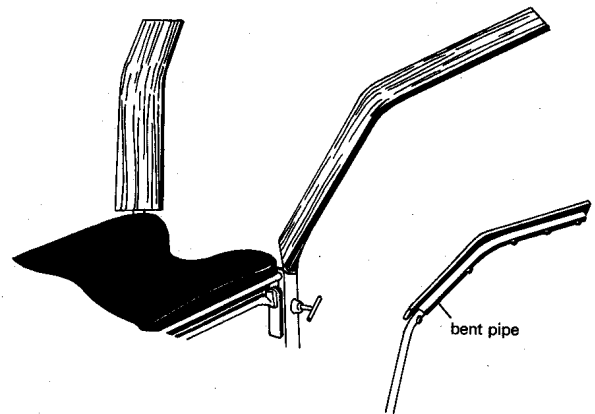
CHOGORIA SUPPORTS

bent pipe

Fig. 19-3 CHOGORIA SUPPORTS hold the legs only partly flexed, so that you can have simultaneous access to the abdomen and the perineum. They are from a mission hospital of this name in Kenya, and are a cheaper locally-made alternative to Lloyd Davies stirrups, or to an attachment for an operating table that enables you to angle its lithotomy poles.

Clean the abdomen, perineum, and vagina, empty the bladder with a catheter (if it is not empty already), and cover her with an abdominal sheet. Pass a Sims or Auvard's speculum.

If >10days have elapsed since the 1st day of the last period, consider doing a D&C or suction curettage (23.4), to prevent implantation in this cycle. You may need paracervical anaesthesia.

INCISION depends on the position of the fundus.
If delivery has occurred within 4days, and the uterus is at the umbilicus or can easily be pushed there, make a 2cm horizontal incision in the inferior fold of the umbilicus. This is good cosmetically, and avoids the need for shaving. Also the abdominal wall is thinnest here.

If she is not postpartum, make a short transverse incision just above the pubic hair. If you have inserted a uterine manipulator, moving it helps you to decide where to operate exactly. Ask an assistant, with the manipulator, to raise the fundus against the abdominal wall until you see and feel a bulge (19-4A). Alternatively manipulate it yourself through the towels (experienced doctors can do this operation if need be without an assistant).

If you make an umbilical incision, stretch it and make a 2cm horizontal incision in its inferior fold. Spread (*do not cut*) the subcutaneous tissue moving laterally with scissors until you see the fascia. Insert 2 small narrow right-angled retractors, and pull them apart laterally, while using them to pull aside all tissues between the skin and the fascia.

Pick up the fascia between two haemostats (one as much as possible to the right and one as much as possible to the left), and inject another 5ml lignocaine just beneath the fascia to anaesthetize the peritoneum. Open the fascia horizontally with a knife over the ridge you create when you lift the haemostats. You will find the fascia and the peritoneum fused so lifting it up prevents you cutting too deep.

If the peritoneum is not open yet do it bluntly by pushing closed forceps or scissors through it and pulling this instrument out in open position. The incision in the fascia should be large enough to admit your index finger. The skin will stretch, so you can make the skin incision shorter than the fascial one.

If you make a suprapubic incision, you have a similar approach but the incision is somewhat larger (reverse correlation with your experience). Enter the peritoneum as high as possible in your incision to stay away from the bladder.
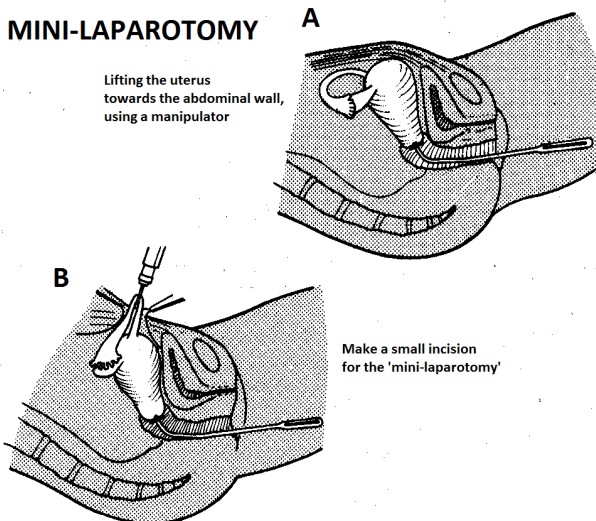

Fig. 19-4 MINI-LAPAROTOMY.
Use a special manipulator to push the fundus up against the abdominal wall, so that a very small incision can be made in the abdomen. *Do not use this immediately postpartum or post miscarriage.*

After delivery, use your finger to locate a tube and sweep it from behind the uterus medially, visualize it and grasp it. You can easily move the uterus from left to right by pushing against it through the abdominal wall to let the tubes approach the umbilicus. Alternatively the incision can be moved with the retractors from left to right.

In the elective situation, using your finger is not such a good idea. It tends to hurt the patient, causing her to push. Bowel then appears in your incision and you can get stressed, operate more roughly, cause more pain, and so more pushing. Try to visualize the tubes and then pick them up (as distally as possible) with Babcock forceps. Your chances of seeing them increases with an easily directed light, a steep head-down tilt, a manipulator, the availability of a special instrument to fish out the tubes (a small ring on the end of a strait wire attached to a handle), patience, and an assistant talking to the patient, helping her to relax and breathe deeply. If all else fails, 100mg ketamine IV at this stage will help.

N.B. The tube is the middle (and top one) of the three lateral attachments to the fundus (dorsal ovarium, ventral round ligament) and has a lumen.

Introduce some LA between the two blades of the mesosalpinx near the tube where you plan to tie it. Excise a segment, having ligated a loop (19-2).
CAUTION! Check very carefully that there is no bleeding, cut the sutures on the tube, and then operate on the other tube in the same way.

Close the fascia with continuous #1 monofilament. Close the subcutaneous dead space to minimize oozing. Close the skin with subcuticular absorbable.

DIFFICULTIES WITH A MINI-LAPAROTOMY
If there is pain after you injected the LA, add sedation. A wide area of LA should prevent this.

In obesity, it will be difficult to pull the tubes into view through a layer of fat. Enlarge the incision and apply more head-down tilt. An umbilical incision may be easier than you expect, because there is less fat around it
.

If you cannot find the tubes,
(1) The incision may be too far above the fundus; it should be slightly below it. Turning the uterus with your finger behind might help if you are desperate. You may find it helpful not to release the first tube, until you have moved across the fundus and found the other one. Try passing Cusco's speculum through the incision to help you look around.
(2) The uterus may be stuck down with adhesions. A careful initial pelvic examination should have excluded this. Dense adhesions require GA to enable you to operate safely. If the tubes are adherent to the uterus or the pelvis, you may have to make a standard incision, or abandon the operation. This is particularly likely to happen if there are adhesions following Caesarean Section.

If you find any ovarian cysts, leave them if they are <5cm. Often normal ovaries have some physiological cysts. If a cyst is larger or a possible dermoid, collapse it by draining it with a syringe and needle, pull it into the wound, and excise it.

If you open the bladder, close it with absorbable sutures in two layers, and leave a catheter *in situ* for 7days. Prevent a full bladder by having her empty it just before she enters the theatre. If you find it full at surgery, empty it with a catheter or a needle and syringe.

If you open the bowel, close it in two layers transversely, and observe closely for signs of sepsis, abdominal tenderness or distension suggesting a bowel leak.

Once you have mastered the mini-laparotomy technique, you can also use it for ectopic gestation (or ovarian cysts).

19.5 Using a laparoscope

A standard laparoscope is a <1 cm diameter tube, which you insert through a tiny incision near the umbilicus, and which you can use to inspect the abdomen. You can also perform a variety of minor operations through it, including tying the tubes.

Because a standard laparoscope with its associated equipment is fragile and expensive, a simpler and more robust instrument, the 'Laprocator', is used by the Johns Hopkins Program of International Education in its Gynaecology and Obstetrics (JHPIEGO) programme, and is specially adapted for use under difficult conditions. It is only suitable for tubal ligation, removal of a perforating IUD and diagnostic inspection of the peritoneal cavity with tissue biopsies, but not for the other procedures which are possible with a standard laparoscope. Unfortunately, like a standard laparoscope, it also needs special training, which is usually given at JHPIEGO courses, a laprocator being given free to all those who pass the course, and who can demonstrate that they have adequate facilities. It is described here, so that it becomes more widely known and it might be that you have experience in laparoscopy and you find a laprocator in a cupboard in your hospital and plan to use it. A laprocator is robust, reliable, and relatively inexpensive, and is popular with patients. You can use it with LA, but you may find using it more convenient with ketamine. You can use a cylinder of carbon dioxide but because you are not using diathermy inside the abdomen, you can use air instead. However, if you use carbon dioxide and not air, there is no risk of air embolism.

Alternatively, you can use a cystoscope (19-6), insufflating the abdomen with a standard sphygmomanometer cuff, for diagnostic purposes, using the working port for the biopsy instrument, but this does not allow you to perform a tubal ligation.

If you are skilled and have a good team, laparoscopic ligation is quick, and safe, and can be done on outpatients. The incision is so small that it soon becomes almost invisible. Because you use rings instead of diathermy, you will not easily injure the bowel.

There are disadvantages. A laprocator is still quite delicate, and the possible complications include perforation, air embolism, and bleeding, and introduction of infection if the instrument is improperly sterilized.

You can introduce the laprocator through a small laparotomy incision, or you can use a special trocar in combination with a special spring-loaded (Veress) needle to introduce the gas. If you are a beginner, start with the open laparoscopy method, which is safer and does not need a gas supply. The only disadvantage of the open method is that the skin incision is slightly longer, and needs two sutures instead of one.

Laparoscopy has caught the imagination of doctors and patients. If you demonstrate it at health education talks, you can be sure that some mothers will come forward afterwards to have their tubes tied.

INDICATIONS.
(1) Sterilization.
(2) Diagnosis of PID, endometriosis, and infertility.
  N.B. A laparoscope is not much use in the diagnosis of ectopic gestation. The diagnosis is usually obvious anyway by the time the patient presents and you won't see anything but blood through your scope.
By doing a mini-laparotomy you not only confirm the diagnosis but you can also repair the damage and perhaps collect blood for autotransfusion (5.3) without wasting time.

CONTRAINDICATIONS.
(1) Most lower abdominal scars. However, if you are experienced, you can perform a laparoscopy, if the scar was for a lower-segment Caesarean Section, because it seldom causes adhesions between the bowel and the abdominal wall.
(2) A history of chronic PID with possible adhesions.
(3) Extreme obesity.
  N.B. Mild obesity is an indication for laparoscopy, because the incision does not have to be larger if a patient is mildly obese, as it does in a mini-laparotomy.

PREPARATION.
Place the patient into the semilithotomy position, as for a mini-laparotomy. Clean the abdomen, perineum, and vagina. Let the patient empty the bladder just before the operation. Pass a uterine manipulator or vulsellum and attach it to the cervix. Move the uterus up to the abdominal wall. Wait until she is relaxed and not coughing. Tilt the head downwards.

USING THE VERESS GAS NEEDLE (GRADE 2.3)

If you are right-handed, stand on the patient's left. Make a small cut in the skin of the lower border of the umbilicus, and dissect down till you can see the peritoneal layer. Lift this up, and holding the abdominal wall with your left hand, with your right hand insert the Veress needle through the peritoneum almost at right angles to the skin, pointing it in the direction of the pouch of Douglas. Hold it by the barrel, so that the blunt trocar is free to slide up and allow the cutting needle to enter.

CAUTION: Use some of the following methods to check that the end of the Veress needle is indeed in the peritoneal cavity:
(1) You are able to move its point freely from side to side. Be careful as you do this, and *don't use force*, because you may tear adhesions.
(2) When you lift up the abdominal wall you can hear air rushing in through the needle.
(3) A drop of saline, placed over the hub of the needle, is sucked in when lifting the abdominal wall.
(4) After injecting 5ml of saline through the needle nothing can be sucked back.
(5) Gas flows freely into the peritoneal cavity with little resistance.
(6) A small volume of gas obliterates the normal dullness to percussion over the liver.

N.B. There will be a normal range of insufflation pressures for your machine, shown in green on the dial. If the pointer moves to the red area, the needle is probably in the wrong place.
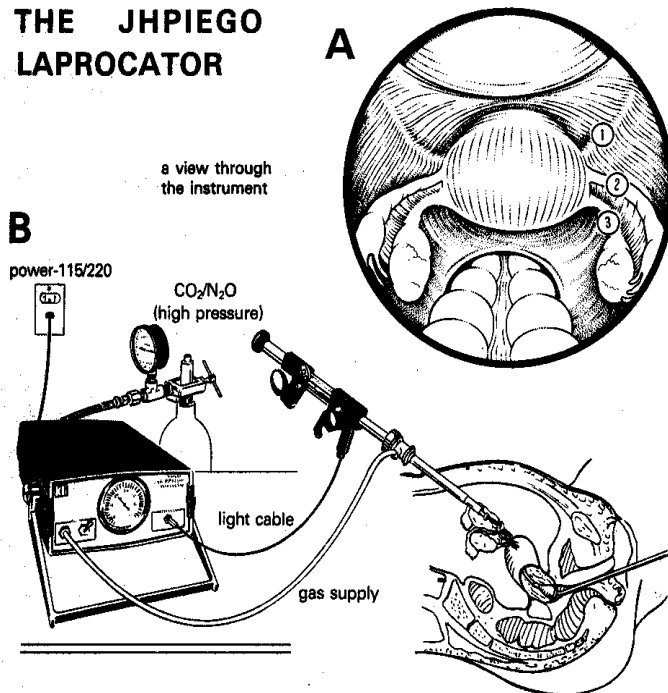
THE JHPIEGO LAPROCATOR

Fig. 19-5 THE JHPIEGO LAPROCATOR.
A, view through the eyepiece. B, instrument in use. (1) the round ligaments. (2) the tubes. (3) the ovarian ligaments.

Let the gas flow into the peritoneal cavity. A multipara who is being sterilized needs up to 4l (2l is usually enough). A nullipara who is having a laparoscopy for diagnosis needs 2-3l. Many insufflators do not measure volume, but carbon dioxide flows at the rate of *c*.1l/min, so allow it to flow for 2mins.

Remove the Veress needle, and enlarge the skin incision with a scalpel, until you have a 1·5cm horizontal incision at the lower border of the umbilicus. Insert the trocar and cannula. Push it in the same direction as you (should have) pushed the Veress needle. *If you haven't made the opening big enough, you will have to push quite hard, especially if the trocar is blunt: this is dangerous, and the trocar is difficult to control.* Keep it in the midline. When it is through the peritoneum, withdraw the trocar, and insert the cannula fully. Then insert the laparoscope. Connect the gas tube to the cannula for insufflation.

Look for the Fallopian tubes. *Make sure they are indeed the tubes by confirming that they*:

(1) join the uterus at the *cornua*, whereas the round and ovarian ligaments join below the *cornua*.

(2) are in the middle behind the round ligaments and in front of the ovarian ligaments.

(3) end in *fimbriae.*

(4) easily form a loop when pulled up, much more easily than the round or ovarian ligaments.

N.B. You can clean the laparoscope lens by gently wiping it on tissues within the abdomen, but beware: *a long contact may burn tissues if the bulb is hot*, and it may be safer, taking it out and cleaning the lens with a warm moist gauze.

If you have difficulty manipulating the tubes, try inserting the gas needle in the midline 5cm below the umbilicus *under direct vision of the laparoscope*. Use the needle to help you manipulate the tubes. Otherwise push the cervix down using a vulsellum forceps and so elevate the fundus and identify the tubes.

Apply one ring to each tube. Withdraw the laparoscope. Open the valve to expel the gas, and remove the cannula. Close the skin with one suture or a skin clip.
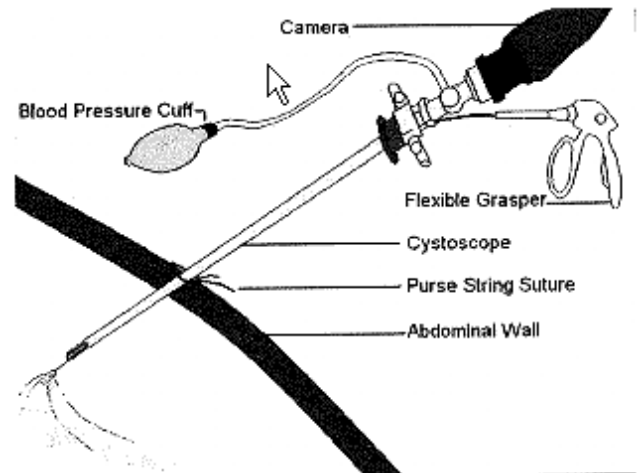

Fig. 19-6 USING THE CYSTOSCOPE FOR LAPAROSCOPY.
Fix the cystoscope with a purse-string suture on the abdominal wall. Insufflate with air using a sphygmomanometer cuff. Use the biopsy channel for instrumentation.
After Gnanaraj J, Diagnostic laparoscopies in rural areas: a different use for the cystoscope. Tropical Doctor 2010(3):156

OPEN LAPAROSCOPY WITH THE LAPROCATOR

METHOD. Proceed as above under direct vision, so you are able to introduce the laprocator with its cannula, but without its trocar. Use 2 towel clips to tighten the skin around it and prevent gas leaking.

Fill the peritoneum with 2l of air. The laprocator control box has a small air reservoir which is filled by a rubber pump. Air is only slowly absorbed, so take care to let it all out when you have finished. If you allow air to get into the wrong place, for example into the extraperitoneal tissues, it will obscure the view. You will not be able to try again after a few minutes, because air takes hours to be reabsorbed, unlike carbon dioxide which is quickly absorbed.

DIFFICULTIES WITH THE LAPROCATOR

If there is extensive bleeding, cross-match blood, perform a laparotomy and search for the source of bleeding (usually mesenteric vessels). Pack the area if the source is not immediately visible, and then after 5mins, carefully remove the packs to look again.

If you cannot see the tubes, try the manoeuvres described; if these fail, perform a laparotomy.

If you mistakenly put a ring on something which is *not the tube* (e.g. *the appendix, round ligament or even ureter*), you can usually pull it off again by catching its edge with one prong of the laprocator forceps. If this fails, perform a laparotomy: *do not assume the ring will not cause harm!*

If you perforate bowel with the trocar, perform a laparotomy and oversew the perforation with two layers of 2/0 absorbable (14.3).

If you perforate the bowel with the insufflations needle, observe the patient closely. Unless peritonitis develops, you don't need to perform a laparotomy.

19.6 Vasectomy

Although it is a simple operation, it must be done well, because its success as a family planning procedure depends on there being very few side-effects.

The normal vas is about 2·5mm in diameter. When you pinch it between your finger and thumb, it has a characteristic firm cord-like feel. It is difficult to feel immediately behind the testis, but between the upper pole of the testis and the inguinal ring you can feel it quite easily, and deliver several centimetres of it through a small incision in the scrotum. Rarely, it is double, which is one reason why vasectomy occasionally fails.

After you have incised the skin, you will meet the superficial fascia containing the *dartos* muscle. Deep to this lies the connective tissue which surrounds the spermatic cord. When you reach the vas, you will find that this also has a sheath of its own. Take care:
(1) *Don't injure the veins of the spermatic cord* (the pampiniform plexus), which will bleed during the operation, and possibly afterwards also.
(2) *Don't tie the testicular artery*, or the testis will atrophy.

FORCEPS, vasectomy. Get these if you plan to do many vasectomies.

CONTRAINDICATIONS to vasectomy as an outpatient include: a varicocele, a large hydrocoele, a local scar, an inguinal hernia, genital tract infection, diabetes, recent coronary heart disease, and filariasis.

Do not do this procedure if the family situation is unstable, the man has fathered less than 2 children or he is <30yrs old.

Always examine the scrotum before you advise a vasectomy: *you may not be able to feel the vas!* There may be a double vas present on one side! There may be significant pathology there, *e.g.* condylomata.

PREPARATION.
Explain the purpose of the procedure is to prevent sperms reaching the ejaculate; emphasize that there is no effect on libido. Advise that this is a permanent measure: reversal is extremely difficult even with microscopic techniques.

Inform the patient that it will take *c.*12 ejaculates to clear all live sperms distal to the vasectomy, and so he cannot assume he is sterile immediately after the procedure. Tell him that very occasionally the vas can rejoin. Get him to sign to an appropriate consent form which includes these points.

Ask him to soak in a bath and shave the scrotum before the operation, and bring with him a tight-fitting undergarment to support it afterwards. Take careful aseptic precautions.
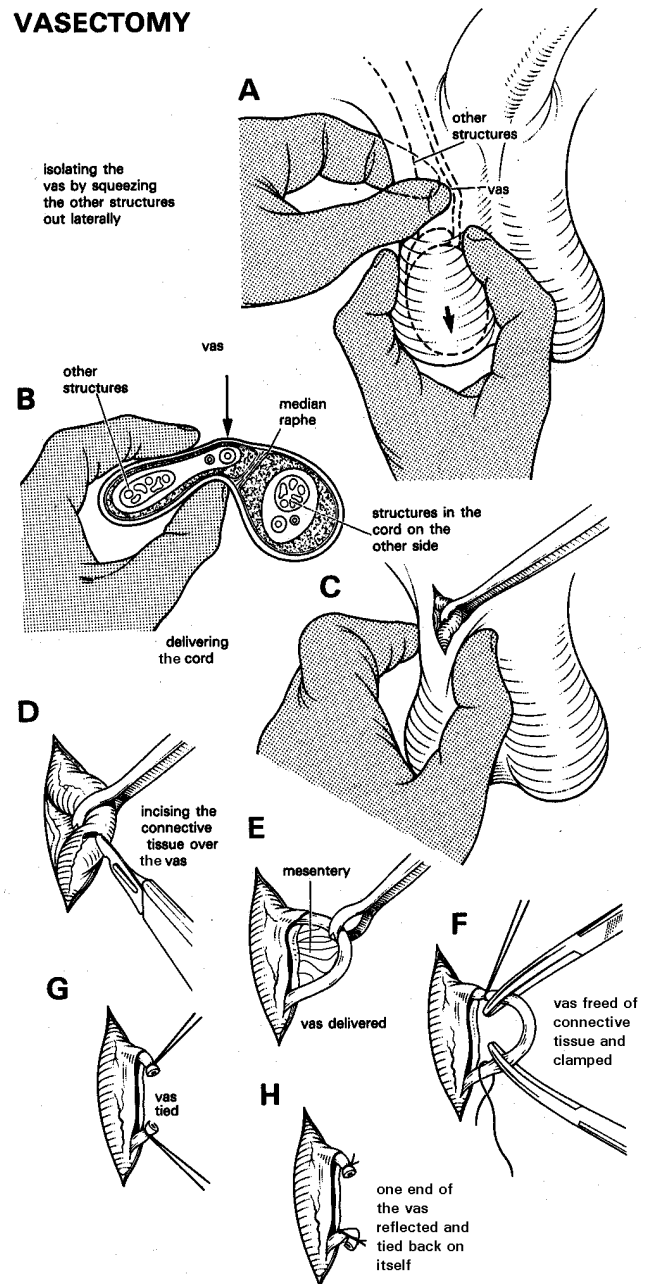

Fig. 19-7 VASECTOMY.
A-C, isolate the vas from the other structures in the cord. B, *N.B.* the pampiniform plexus and testicular artery are in the 'other structures'. D, incise over the vas. E, deliver the vas. F, free and clamp the vas. G, tie the vas. H, reflect one cut end of the vas.

VASECTOMY (GRADE 2.1)

Stand on the right. Find the vas where it is easily palpable in the scrotum. Pull on the spermatic cord just above the testis, with the thumb and index finger of your right hand. Assuming you are right-handed, use the thumb and fingers of your left hand to manipulate the cord, so as to push the vas upwards and laterally. Isolate the vas from the other structures, by squeezing them out of the way (19-7A).

Hold the vas well above the testis with your thumb over it and two fingers underneath it. If the skin is thin you will be able to see it. Pulling on it will cause him some discomfort, and pain referred to the abdomen. This is a useful sign that you have indeed found it (19-7B).

CAUTION! *Make sure you have isolated and anchored the vas in the manner described*. This is the critical step. Doing it without causing discomfort needs practice.

ANAESTHESIA.

With the vas now anchored, find an area in the skin which is free of cutaneous blood vessels, and use 1% lignocaine to raise a small wheal. Then push the needle deeper and inject 1-2ml as close to the vas as you can, while holding it away from the other structures in the cord. If he has persistent discomfort while you are handling it, inject more solution into its sheath.

CAUTION! *Don't infiltrate the other structures in the cord*. This is unnecessary and dangerous, because you may injure the pampiniform plexus. If there is adrenalin in the anaesthetic solution, it may constrict the vessels, and make the testis temporarily ischaemic and painful.

DELIVERING THE VAS. While still firmly anchoring the vas, incise the skin 1cm over it transversely down onto the vas. If you inadvertently divide the vas, it is not a problem! Grasp the vas with the forceps (an Allis tissue forceps can substitute for a special vasectomy forceps) (19-7C).

If you cannot lift out the vas, gently cut deeper or push the tip of mosquito forceps through the incision, and split the *dartos* vertically. Then push the vasectomy forceps into the incision and lift out the vas. Confirm that the vas has not slipped away by feeling it with these forceps: it has a characteristic feel, and you will see the tiny lumen of the vas when you cut through it.

CAUTION! *Don't mistake the vas for thickened bands of cremaster muscle, thrombosed veins, thickened lymphatics, or calcified worms.*

ISOLATE THE VAS FROM ITS SHEATH by levering the tip of the forceps upwards by lowering its handle. Use a #15 blade to incise the connective tissue over the vas vertically in line with it. Make sure that the connective tissue is completely divided by continuing the incision into the vas itself (19-7D).

Hold a segment of the exposed vas with another forceps. If you are confident this is indeed the vas, release the first forceps. If you have judged the site and depth of your incision correctly, you can now easily pull out the vas, leaving only a thin mesentery on its medial surface (19-7E).

Use mosquito forceps to make a small window in a piece of the mesentery of the vas which is free of blood vessels. Isolate a 1-3cm segment of vas between clamps keeping far away from the epididymis.

Tie its clamped ends with absorbable suture, placing your ties beyond the clamped area (19-7F). Leave one end outside the connective tissue by suturing it to the outside sheath and the other end reflected inside in order to minimize the risk of natural re-anastomosis. Excise the isolated segment (19-7G), and keep it for histological examination. You may not need to send this but it is worthwhile keeping in case there are subsequent problems.

CAUTION!
(1) *Don't put the ligatures over the crushed area.*
(2) *Don't tie them too tight*, or they will cut out.
(3) To begin with, leave the ends of the sutures long, so that, if the cut ends of the vas bleed, you can pull them back into the wound. Pull on the testis to separate the ends of the vas. Inspect the wound. If it bleeds, pull out the ends of the vas, and tie any bleeding vessels with absorbable suture. Then cut the ends of the ligatures short and drop them back.

CAUTION!
(1) *Don't damage the pampiniform plexus.*
(2) Control all bleeding carefully. A small vessel can form a big haematoma later. Bleeding can also come from the skin edges, from the fascial sheath covering the vas, or from the pampiniform plexus.

If the incision is <1cm, the skin edges may come together without any sutures. Otherwise, suture them with catgut, *not long-lasting absorbable as the suture becomes mushy and often infected*.

Repeat the same procedure on the other side of the scrotum through a separate incision. You may prefer to move to the opposite side of the patient.

Place swabs on both wounds, and hold them with a crepe bandage tightly wound round the scrotum, held in place by tight underwear. *Don't use adhesive tape on the scrotal skin!*

HAEMOSTASIS MUST BE ABSOLUTE

CHECKUP.

Warn the patient that he may not become sterile for up to 3wks. His wife should continue to use a contraceptive:
(1) until 2 examinations of the ejaculate have shown no sperm, or
(2) until he has had 12 ejaculations after vasectomy.

To examine the ejaculate, ask him to produce a specimen by masturbation, or from a condom after intercourse. Examine this for sperms under a low power microscope. There should be none.

If sperms are found, repeat the test after a further 3wks, advising precautions as above. If they are again found, re-explore the scrotum as below.

DIFFICULTIES WITH VASECTOMY

If you cannot find the vas, *don't continue the operation under LA* as an outpatient. The patient will need some sedation.

If you lose the cut ends of the vas after dividing it, the ligature may have slipped, or you may have released the forceps holding the vas too soon, and let them be drawn quite a distance into the scrotum. *Don't injure any blood vessels.* If there is no bleeding, leave things well alone.

If there is bleeding, try to recover the ends by systematically palpating the vas, and feeling for its ends with forceps.

If you cannot find the cut ends, strap the scrotum tightly leaving the wound open and admit the patient for bed rest. Tell him that you have had difficulty, and watch for haematoma formation. Check later to see that the ejaculate becomes sperm-free.

If a haematoma forms, it may spread into the scrotum, the thighs, or the abdominal wall. If it is small, it will disappear spontaneously. If it is larger, you may have to admit him and evacuate it.

If deep infection in the scrotum develops, suspect HIV disease or diabetes and drain the sepsis as for Fournier's gangrene (6.23).

If histology fails to confirm vasectomy, explain that you need to re-operate under GA or ketamine.

If the patient's wife becomes pregnant, either vasectomy has failed, or he is not the father! If sperms are present in the ejaculate, you can either re-explore the scrotum under GA or ketamine, and perform the operation again, or offer the wife sterilization. If sperms are not present in the ejaculate, consider carefully what you should or should not tell him!