

Medi-Vision™ Film Transcript

Programme 33

Principles and Practice of Anaesthesia (1)

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DVD version 2006

Prof Cedric Prys-Roberts

Introduced by

David C Anderson

Introduction

DCA Cedric Prys-Roberts who is with me today is Professor of Anaesthetics at the University of Bristol and Consultant Anaesthetist at Bristol Royal Infirmary.

Cedric, on this film we see you anaesthetising two patients.

C P-R Yes.

D And they illustrate I think quite a lot of the principles of anaesthesia.

Can you just tell us in general terms what are we aiming for in anaesthesia?

C Well the main thing that we are aiming for in the first place is **to render a patient insensible**, that is unconscious, so that they are unaware of their surroundings during surgery. And at the same time to **suppress their physiological responses to the noxious stimulation** which surgery represents, so that they end up having a painful operation without feeling anything at all.

D Right, and in order to achieve that what are the principles that you follow?

C Well the principles that we follow are first of all we need a drug that renders people unconscious, that's what we mean by the term anaesthetic.

But **anaesthetics on the whole do not cause analgesia** - that is relief of pain, and therefore we use other drugs sometimes opioids, sometimes local anaesthetics to provide us with analgesia which outlasts the surgery and lasts into the post-operative period.

D Right. And what about the question of **maintenance of the airway and ventilation** during anaesthesia?

C Well all anaesthetics depress the bodily functions, one of which is maintenance of the airway, and therefore patients can obstruct and be unable to breathe adequately.

And under those circumstances we have to have either mechanical or other methods to ensure that the patient's airway is maintained at all times.

And there are times when we deliberately use drugs in such a way that we stop the patient from breathing and then we have to control their ventilation for the whole period of the anaesthetic and maybe into the post-operative period.

D And this is the use of muscle relaxants?

C **Muscle relaxants are a separate issue** in that in order to provide a relaxed abdominal field for the surgeon we may need to use specific muscle relaxants as opposed to the general effects of the general anaesthetics.

We may also need to use muscle relaxants to provide adequate conditions for placing a tube in through the larynx that is endotracheal intubation.

D Well we will now look at our first patient who is a young woman with a large right-sided goitre.

Patient 1

C P-R Okay, now we are going to start by putting a little infusion into your arm, and all you will feel is a little tiny sting of local anaesthetic to freeze the skin.

A little tiny sting now..... and you shouldn't feel any more than a little push.....

Okay let go.... thank you.... and the drip to connect, and let it run..... okay, and a dressing. That's the most difficult part of the whole procedure as far as you are concerned, and that wasn't too bad.

So we have the intravenous infusion in place, and that's the first thing that we want in all general anaesthetic procedures... that we have an open vein so that in the event of any difficulties we always have access to an open vein.

We have a **standard monitoring system** which consists on the top left there of a **pulse oximeter** which is attached to the finger and which measures the oxyhaemoglobin saturation which is now showing 97 per cent on air.

And below that is a **non-invasive blood pressure monitor** which is showing that the last blood pressure recorded as 126 over 75 with a slightly fast heart rate of 102.

And that shows up on the **ECG monitor** on the right-hand side, and that is our standard monitoring in the anaesthetic room.

The **intubation tray** consists of the endotracheal tube which is a cuffed plastic tube; a set of laryngoscopes ready to go and all the other ancillary equipment which we may need.

C *Just hold it **in front** of her face... not on the face.*

For the induction sequence we are going to start with some fentanyl intravenously... and the effect that that will have is to make the patient feel a little bit light-headed, and after that she will begin to feel very warm all over.

And I am going to **start with a dose of 300 micrograms of fentanyl** and wait until that takes its effect.

No, that's fine.

I say that will make you feel a little bit light-headed to begin with...

Is that beginning to come on already?

Jolly good. That's fine... and you will begin to feel very warm all over.

And then we give a **priming dose of atracurium** which is a very small dose of muscle relaxant...

And again... one more deep breath....

Followed by the induction dose of propofol.

Quite comfy... and I'd like you to take a really big deep breath now.. the biggest deep breath that you can.....

that's good and out again... and then breathe quite normally.

And I shall ask you to take deep breaths all the time as we go along.

And I've given her 60 milligrams of propofol

And another big deep breath in..... jolly good... that's fine... well done, that's great.

And you can see that the eyes have closed now.

Another deep breath in for me..... good, well done.... that's fine.

And one more.... one more big deep breath in..... that's fine.

That tells me that I need to increase the dose of propofol a bit.

And again... another deep breath in for me....

She still needs a little bit more propofol.

C So that's a **total of 100 milligrams of propofol for the induction phase.**

That should be plenty.

And again... one more deep breath.

And the **patient is no longer responding to command**, so I am reasonably safe to give a full dose of muscle relaxant at this stage, that's 40 milligrams of atracurium.

And at this stage I can take over the mask and as the patient is now no longer able to breathe, **I will take over the breathing manually, and at the same time start giving her some sevoflurane.**

At this stage I am waiting for the effect of the muscle relaxant to become maximum... it takes about 90 seconds to get the full effect.

The effect of the fentanyl that I gave first should be fairly maximal at this stage.

I am turning that up to four per cent sevoflurane at this stage **to over-pressurise in terms of partial pressure of sevoflurane for ventilation of the lungs.**

And I am now able to artificially ventilate the lungs manually without any difficulty at all, indicating that there is no respiratory obstruction.

I am now **increasing the sevoflurane to six per cent....** I have to make absolutely certain that as we want to maintain the anaesthesia at a satisfactory level particularly during the

phase of the intubation, the effect of the initial propofol would begin to wear off fairly quickly, and therefore one has to make quite sure that whatever volatile agent one is using, the effect becomes maximum at the time that one wants to intubate the patient. Once that has been achieved then we can turn the concentration down.

Intubation

- C And **the process of laryngoscopy to order to do that, is a fairly noxious stimulus.** In fact **in terms of the sympathetic response that it induces,** one could say it is even more noxious than a surgical incision. And therefore we have to make absolutely certain that the patient is adequately anaesthetised before that occurs. *Now could you run another blood pressure first before we do any more?* I'm just waiting to see the result of the blood pressure reading before I proceed to laryngoscopy. And as you can see... **the blood pressure has fallen from 126 down to 83 which is not an undue decrease and is consistent with normal anaesthetic practice.** The muscle relaxant should be fully effective by now. Therefore I am going to intubate the patient. Place the head in the correct position.... allow the mouth to fall open so that when we put the laryngoscope blade in at an angle, allowing me a **complete vision down the throat of the epiglottis and the cords which I can see quite clearly....** and I can then place the tube in between the cords, remove the laryngoscope and connect up.... and then resume artificial ventilation of the lungs. We inflate the cuff... *that's a little bit too much... just withdraw a little bit.... that's fine.*
- C Good, so the patient is now intubated and we will fix that tube in position with tape.... ensuring that the tape goes around the actual tube and keeps out of the way of the surgeon. And then we will **put tapes onto the eyes to protect the eyes during surgery,** that they can't become opened and damaged in any way. And at this stage we can just check the monitors and ensure that the patient is in an adequate physiological state to proceed into the operating theatre. I am now controlling ventilation manually. **The sevoflurane concentration is two per cent at this stage** which is sufficient to maintain anaesthesia while there is no surgery going on. The monitors that we use during this phase are set to provide alarms should the values drop below the predetermined levels that we set on them.
- C This is the **correct position for the patient's head and neck for thyroidectomy,** in that we need extension of the head and a slight head-up tilt to minimise blood loss by allowing venous drainage from the neck veins down into the heart. The anaesthetic machine is connected from the side here with monitoring of the gasses from the circuit, and all the other monitors are connected to the patient. And we have ready access to the intravenous line through a three-way stop cock should we need it. The monitors that we are using which are standard for all surgery, is a Hewlett-Packard Merlin system which shows the haemodynamic variables and the carbon dioxide and the saturation readings on this part of the screen.... so she has a heart rate of 70, a blood pressure of 96 over 44, her end-tidal CO₂ is 36 at the present time, although I'd like it just a wee bit higher than that, and the oxygen saturation is 99 per cent. Notice that **in order to achieve this end-tidal CO₂ we have some degree of rebreathing,** and that is quite deliberate. We are using a circle system without an absorber to allow selective rebreathing enabling us to over-ventilate the lungs and thereby keep the lungs well inflated but at the same time maintain a normal end-tidal CO₂.
- C The other gas monitor shows some of the same variables of the end-tidal CO₂ and the inspired and expired oxygen levels, but it also gives us an indication of the inspired & expired sevoflurane concentrations which we shall try and maintain at about two per cent during the surgical procedure.

- C Just before the surgery commences I am going to give the patient **another dose of fentanyl, another 100 mcg to anticipate the surgical incision.**
I am also going to **increase the sevoflurane concentration to 4 per cent** inspired to ensure that I have an adequate alveolar or end-tidal sevoflurane concentration immediately before the incision.
And I am now going to turn down the sevoflurane concentration down a little bit because I've got the expired concentration up to 2 per cent which is more than adequate at this stage of the procedure.

Theatre: Professor John Harnden

- J This young lady is 28 years old and has a dominant right-sided thyroid swelling which is symptomatic in terms of obstruction of swallowing and obstruction of her breathing. It is benign on cytology and has a complex pattern on ultasonography.
Are we planning to start Cedric?
- C Yes, okay, yes.
- J Going down now to the platysma muscle which you can just see in the edge of the wound there....
Just diathermying the muscle on that side of the wound... and on this side of the wound... and then we will raise a superior and inferior flap.
Beneath the platysma there is a very nice natural plane... you can see the large anterior jugular veins here... beneath the flap.
- D That's always the case isn't it?
- J It is.
So we have the upper flap and the lower flap held apart on this Johns retractor.
This is a large thyroid swelling.
We have made rather a small hole... and we may have to extend our incision, but we will begin and see how we go.
We are now going to divide the strap muscles of the neck which run longitudinally, and we are going to go and look for the middle... between these muscles, the right and left-sided group, avoiding the anterior jugular veins.
- C We are **artificially ventilating this patient using a constant flow generator**, the Oxford Penlon ventilator which produces a volume controlled breath at a pre-set inspiratory and expiratory time and at a pre-set rate.
And the system that we are using is a circle without an absorber.
Most people are accustomed to using a circle system whereby the expired gas is returned into the inspired port of the ventilator, so it acts as a circle system, and normally one would have a soda-lime absorber in this part of the circle.
The advantage of using this system is that we can still run on low fresh gas flows and we are using a combination of air and oxygen without any nitrous oxide with the inspired sevoflurane. And as a consequence of using the circle system without an absorber we can then maintain good lung inflation throughout the ventilatory period, and at the same time we are **producing deliberate rebreathing so that the inspired CO₂ is approximately 20 mm mercury, and that enables us to maintain an end-tidal CO₂ close to the ideal value of between 38 to 40.**
And in this way we **can volume over-ventilate the lungs** but at the same time maintain the blood CO₂ at the correct level, and that **maintains the chemoreceptors in the medulla** at their normal values throughout... or their normal settings throughout the anaesthesia. And when she starts to breathe again she will breathe at her normal volume and **this will maintain normal breathing during the post-operative period** even though we have given her fairly large doses of opioid - that is fentanyl during the surgery.
- J And under the right side of the strap muscles is beginning to protrude this huge dominant nodule within the right lobe.
It is actually extending down into the inlet of the mediastinum.
My forceps here... is right on the clavicle and the nodule is going on down into the root of the neck of the chest.
And the effect of this is huge venous distension on and around the thyroid gland.
- C The concentration of sevoflurane that we are using in this patient is consistent with the patient being ventilated with air and oxygen which you can see on the flow meters.

Therefore we are using a combination of sevoflurane as a volatile anaesthetic agent with a modestly high dose of fentanyl.

The patient has had about 500 mcg of fentanyl at this stage.

And that means that the alveolar concentration of sevoflurane which we might need will be of the order of 1 per cent.

We can be fairly sure at this stage watching the haemodynamic responses: that is the blood pressure and the heart rate - all of which have been extraordinary stable throughout the anaesthetic, that we are giving a sufficient and adequate concentration of sevoflurane.

C **Sevoflurane** is a relatively new volatile anaesthetic, and it is an anaesthetic which is metabolised to free fluoride. But the concentrations of free fluoride which are likely to occur during this type of surgery are relatively low, and in any case the evidence that such levels of free fluoride cause renal damage is no longer tenable. In the old days it was believed that free fluoride was the cause of renal toxicity during methoxyflurane anaesthesia. In the case of **methoxyflurane**, the metabolism is predominantly in the kidney, and Carash and his colleagues have shown that **high intrarenal concentrations of fluoride** occur and this may be the cause of the very high renal and blood fluoride levels that were recorded by Maisie and his colleagues in the past, and the occasional renal toxicity that occurred. Recent studies of sevoflurane anaesthesia have shown that although there are elevated plasma fluoride levels, there is no evidence of toxicity occurring during sevoflurane anaesthesia in man.

C We sample the gases from the patient's airway and these come into the monitor where the detectors will detect a variety of volatile agents which can be pre-selected, and this one is set for sevoflurane at the moment.

It also **detects oxygen, carbon dioxide, and, if we were using it, nitrous oxide.**

I am not using nitrous oxide in this particular case. It is a **good analgesic**, but its analgesic properties only last as long as one is giving the drug.

Over many years now we have been gradually dropping the use of nitrous oxide and using combinations of volatile anaesthetic vaporised in an air oxygen mixture, and modestly **high doses of opioid** to make up for the analgesic effect of nitrous oxide.

By using the effects of the opioid the analgesia continues well into the post-operative period, and by selecting the dose one can ensure that that at the end of the operation the blood opioid level is predicted to be at a level that can **maintain good quality analgesia for three to four hours post-operatively.**

The **anaesthetic record** is a medico-legal document and it requires that we record accurately all the events and drugs that we give to the patient during anaesthesia.

The drugs are written in capital letters and **the full name of the drug** - not an abbreviation - should be used. All **concentrations and doses of drugs** should be clearly labelled.

And **events** such as the blood pressure and the heart rate should be recorded throughout at the sort of intervals that we are doing here, which is at five minute intervals.

And those show that there has been very good stability of both heart rate and blood pressure throughout the surgical process. And below that we have the **inspired oxygen, the end-tidal CO₂ and the oxygen saturation.**

C **The fluids** that we are giving for this particular patient, we gave her Hartmann's solution to maintain the circulation during the early part of the anaesthesia, and we are now changing to **Gelofusine, a gelatine in saline solution.**

As a result of the blood pressure going up a little bit and the heart rate increasing, I've interpreted this as a slight **increase in sympatho-adrenal activity** and I've therefore increased the sevoflurane concentration and that shows up on the monitor as an inspired of 1.8 per cent giving us an alveolar concentration of 1.5 per cent.

And that seems to be effective in that the blood pressure is now coming down.

JH So there is the **thyroid lobe, totally mobilised** now. We've **preserved and demonstrated the recurrent laryngeal nerve... and the superior parathyroid gland.** To complete the operation we will sweep this parathyroid gland back and then take the gland off the inferior thyroid artery here... and the recurrent laryngeal nerve there.

- C The **changes that we see there on the blood pressure** and the increase in systolic with a steady and maintained diastolic implies an increase in pulse pressure, and implies an **increase in stroke volume** of the heart rather than an increase in vascular resistance. So I would interpret that the patient's cardiac output has increased progressively throughout the surgical process. Partly perhaps due to the surgical stimulation, partly from the fluids that we have been giving.
- J This is the most crucial bit is the division of the thyroid substance at **the ligament of Berry where the recurrent laryngeal nerve enters the larynx**. This is the final connection. These are the superior divisions of the inferior thyroid artery with the parathyroid left on that little pedicle, and the recurrent laryngeal nerve left behind.
We will irrigate the wound and then.....(sounds of irrigation)
So you can see the huge gap where this large lobe once lay. Here is the ligated inferior thyroid artery. You can see the recurrent laryngeal nerve just under that branch entering the larynx, and these are the strap muscles lying over the trachea and the thyroid.
We are closing the wound now... the wound is dry.
We don't leave any drains, there has been much evidence in the literature to show that **drainage is not required**.
We have reconstituted the strap muscles in front of the trachea and we are now going to bring the superior and inferior skin flaps together.
So we are going to bring together the platysma... this thin little muscle layer here... bring those together and then close the skin with clips.
And we will **infiltrate the wound with bupivacaine 0.25 per cent**. And the purpose of this is to try and help the patient wake up with a limited amount of pain within the wound.
- C **The operation is now finished** and we have got the patient to breathe spontaneously again, and you can see the **spontaneous breathing pattern** on the end-tidal CO₂ which at the moment is rising a little bit above the normal level. The other numbers are exactly as we would like them: the heart rate is fine, the blood pressure is fine, the saturation is fine. And we are **about to extubate the patient**, so with the sevoflurane concentration at about 1.1 per cent I can now turn that off in preparation to getting this lady waking up as soon as possible. And **before I extubate her, I am going to suck out the pharynx.....** (sounds). Now that we have sucked her out we can undo the tape on the tube.
The patient is gently swallowing, and I'm going to put the laryngoscope in the mouth so that as **I remove the endotracheal tube I can have a quick look at the larynx** and check that the cords are moving.
Okay... tube down... and she has coughed slightly and I can see that both of the vocal cords are moving... in fact she has stopped and closed her cords for a moment.
I remove the eye tapes... and she is now breathing spontaneously with a clear airway that I can see from the movements of the anaesthetic bag.
So it's now just a question of **straightening out the table, bringing in the bed, turning her on her side, and taking her out into the recovery room**.
- C *Christine, can you just open your eyes for me... well done, that's fine, everything's fine. I'm just giving you some oxygen to breathe. And we are just going to lift you over onto your bed. Just open your eyes again for me.... well done. Okay. Over we come... one, two, three.*
I am now putting the **Hudson mask** on to provide her with adequate oxygenation as she goes out to the recovery room. That is giving her four litres of oxygen with entrained air. I shall just gently hold her chin up during the transfer, although she is responding to command I still have to make sure that the airway is maintained during the transfer out to the recovery room.
- C *The operation is all finished and you are back in the recovery room now. Are you quite comfortable? No pain? Jolly good, that's fine. Everything has gone very well.*

- C That gives a very good demonstration of the **rapidity of recovery from sevoflurane anaesthesia** which being a **very insoluble drug** it leaves the brain and the circulation very fast, and enables the patient to wake up to the point that she can communicate with me and tell me that she is comfortable and that she has no pain.

2 Hours later

- C *Do you know where you are?*
Pt Yes.
C *Yes, you are wide awake now.
It's about two hours after the end of your operation.
How do you feel?*
Pt Fine.
C *You feel fine.
You sound slightly as though you have a little bit of a sore throat, but that will settle down very quickly and by tomorrow it will have virtually gone.
You may notice that you've got a sort of pink area just around there... and that's just the surgical cleaning fluid and that will wash off in time.*
Pt Okay.

The Pre-operative Anaesthetic Assessment Questionnaire

- C *And are they having any adverse effects on you?*
Pt No, not at all.
C Before the patient comes to surgery they usually come to a **pre-assessment clinic** run by the surgeons, usually a week or two before the operation is scheduled. But at that stage the surgeons are just checking that all the things that are necessary for the operation from their point of view have been dealt with. From the anaesthetist's point of view we still have to see the patient beforehand, introduce ourselves, and find out a great deal about the patient in a very short time. In Bristol we have designed this **pre-operative assessment questionnaire** which is very simple for the patients to fill in. It takes them three to five minutes and they are simple yes or no answers to **straightforward questions such as:**
- Do you bring up phlegm from your chest now or at regular intervals throughout the year?
 - Does your chest ever sound wheezy?
 - Do you get more short of breath than other people of your own age, either when climbing hills or stairs, or when walking on level ground?
 - Have you ever had pain or discomfort in your chest when you exercise or hurry, and does it disappear on resting?
- These are obviously questions which are useful in identifying patients who have angina.
- We also ask whether patients have parents who are of **Afro-Caribbean or Eastern Mediterranean origin** because we want to check whether or not they have had a sickle cell test.
 - We ask whether patients smoke; how much alcohol they drink.
 - And then we have a series of questions on the other side which identify things such as heart trouble, high blood pressure, kidney disease and previous problems which the patient may have suffered from.
 - And then we ask the patient what drugs or medicines they may be taking,
 - and whether they have any loose, capped or crowned teeth.
 - And then we ask the patient to sign it.

And we ask them also: is there is anything that you would like to discuss with your anaesthetist?

The **significance of capped and crowned teeth** is that when we intubate a patient we have to put a laryngoscope in the mouth and that can under certain circumstances damage the upper teeth.

Therefore we have to know that there are crowned teeth beforehand and take special care to avoid such problems.

Patient 2: Damian

- CP-R I am Professor Prys-Roberts, and I am going to be giving you the anaesthetic for your operation later this afternoon.
Now I've had a look at the questionnaire which you have filled out and it tells me a lot of interesting things about you.
The first is that you have **high blood pressure and that you have kidney disease.**
And the second thing is that you have asthma and that your chest sometimes sounds wheezy.
- D Yes, purely pollen related in the summer.
But throughout the rest of the year, no problems.
- C It's not a problem... and at the moment you feel free?
- D Yes.
- C And what symptoms do you get then?
- D Walking up the stairs I feel very tight-chested.
- C Really... yes. And you'd wheeze?
- D Yes, I would wheeze.
- C Now the blood pressure I gather is something relatively new?
You didn't know that you had high blood pressure, which was found out by accident when you fainted
- D Yes, last time was about six months ago.
- C And since then your blood pressure has been assessed.
They have found out that you have **polycystic kidneys.**
- C And you have been put on a series of drugs to treat your blood pressure, and gradually those have worked very effectively.
Do they have any side-effects that bother you at all?
- D No.
- C Not at all? So you are reasonably comfortable taking those drugs.
- D Yes.
- C And I understand that you took those drugs last night because that is when you normally take them?
Fine.
Well I don't think that is going to cause us any problem.
Your blood pressure is well under control today, and from my point of view that is fine.
The fact that you have had some wheezing in the pollen season but that you are free now means that I don't think there is any problem from that point of view, so I think that we can go ahead with the anaesthetic.

Now if I explain briefly to you what we are going to do.

- I will give you some tablets to take here in the ward, a couple of hours before the operation which will make you feel relaxed and they may make you feel a little bit sleepy but not too much.
And then they will bring you along to the anaesthetic room in your bed,
And when you are there I will pump some local anaesthetic here... just around that vein... just so you don't feel the cannula going in.
And we will pop a little drip into there... and then once that is running I will give you some instant sleep mixture which will make you feel a little bit light-headed to begin with, and then suddenly you will have fallen asleep.
And you won't know anything about it from there on.
You will be fast asleep throughout the operation and you will wake up afterwards.
That is my job to make quite sure that both things happen.
You will wake up in your bed in the recovery room outside the theatre, and they will keep you there and give you some oxygen to breathe and check your blood pressure, check that you are breathing adequately.
And once the nurses are happy with that they will let you come back here to the ward.
While you are asleep I will put some injections into your groin here... of local anaesthetic which will numb the nerves that supply the area to the groin where the hernia is, so that after the operation it will help to provide complete analgesia - you won't feel any pain there at all.
- D Right.

- C Are there any questions that you would like to ask me about it at all?
- D No that's fine.

In the Anaesthetic Room

- C *Now I am going to give you the sleepy medicine now....
It will take a few moments to take its effect.
And in the meantime would you like to take another big deep breath in for me... that's it, biggest deep breath that you can.
That's good.
And another big deep breath in.....
Okay you can go onto **isoflurane** now... and we want to go onto three per cent.*

- C The alarm is sounding because the heart rate has fallen below the alarm setting, we will set the alarm limit just a wee bit lower than that.
A heart rate of 50 is perfectly acceptable under these circumstances, and it is very largely due to the **combination of fentanyl and propofol**, both of which are **vagotonic drugs** and which slow the heart rate down.
And we are just preparing the patient now to **insert a laryngeal mask**.
Okay... to place the **laryngeal mask** in position one needs to ensure that the patient is properly ventilated first and adequately saturated.
And at that point we tip the head backwards so that the mouth falls open... *pull the chin down...* we push the laryngeal mask against the soft palate and push it in, and if it is in the right place, when we inflate the cuff the tube jumps up a little bit which it did.
And then we tie it in.

The laryngeal mask sits in the pharynx.
When we push it in initially it goes into the hypopharynx, but it is uninflated at that stage.
And **when we inflate the cuff it is too large for the hypopharynx** so it pops up and then it sits immediately behind the larynx.
That's right.

- C That is the fixation position approved by **Archie Brain who designed the laryngeal mask**. If we put it in the neutral position so that the tube is sticking straight out of the mouth, the slightest torsion on the tube alters the position of the mask in the pharynx and may cause obstruction. The correct position of the mask is bent over like that... and in that position if I put a almost complete torsion on the tube there is virtually no movement of the laryngeal part of the mask. And therefore that is the best position to have the mask in the patient. In other words if the patient is lying flat on his back, the mask is like that.... and the tube comes out and is taped down to the chin.

- C This particular operation, an inguinal herniorrhaphy or repair of an inguinal hernia is being done with **the patient breathing spontaneously**, with a laryngeal mask which is much less of an irritation than putting a tube down through the larynx. And it provides a good clear airway for spontaneous breathing. And in order to supplement the anaesthetic so we can run a relatively light level of anaesthesia and give him postoperative pain relief, I am going to insert an **ilio-inguinal block**.

I'm intending to block the two nerves that supply this region: the ilio-hypogastric nerve and the ilio-inguinal nerve which derive relatively from T11 and T12, and which supply most of the area covered by the surgery that we are going to do.
And in order to do this, what I am going to do is to put a needle in in such a way as I can identify the resistance offered by the aponeurosis of the external oblique muscle.
And using a slightly blunted needle, just push the needle through the external oblique, and **both the nerves lie underneath the external oblique and superficial to the internal oblique muscle**.
So I use an entry point which is about a centimetre along a line between the blue marking which is the superior anterior iliac crest and the umbilicus,
And I am going to put the needle at a relatively flat angle with the bevel away from me, and I am going to stretch the skin like that.... and go in through the skin.....

I'm now advancing the needle towards the.... and I can feel the resistance now of the aponeurosis of the external oblique muscle.... and as I go through it I should feel a click.... and there it is.

And then I inject the whole volume of the solution which is **quarter per cent bupivacaine** into that region... and if you take your hand away now and I take the needle out, I should be able to feel, as I can, a sort of deep sausage in the ilio-inguinal region which indicates that I have got it into the right place.

C Ready to go?

And a one, two, three....

In Theatre

C And I'm not happy about that arm... because it is not properly tucked in.

At this stage, just before the surgeon makes the first incision, I am ensuring that the adequacy of anaesthesia is appropriate. So I've increased the inspired concentration of isoflurane and I am watching the end-tidal value and trying to get that above 1.2 per cent before the initial incision.

In response to the initial incision he has increased his depth of breathing ever so slightly and that has resulted in a decrease of end-tidal CO₂. However he is breathing spontaneously, regularly, and is maintaining a near normal end-tidal carbon dioxide at the present time. So I assess from that that he is adequately anaesthetised.

He hasn't moved in response to the surgical stimulus... of course one wouldn't expect him to, and he is continuing to breathe quite normally as the surgeon progresses.

His rate of breathing has increased quite markedly as the surgeon has been pulling on the cord. I am going to give him some more fentanyl because the ventilatory depressant effects of fentanyl will be counter-acted by the surgical stimulus.

And I am going to give him 50 mcg of fentanyl in the first place.

Surgeon This is the actual inguinal hernia itself which is indirect. And we are just going to open it up to see what's inside it. And we just need to have to be sure that this isn't a sliding hernia. He's got the small bits of omentum, so I'm just dividing the attachments of the fat so that I can return the contents of the hernia - which is what one always does - to the abdomen. That is an appendix epiploicus and this is colon, so it is in fact **a sliding hernia**... and it has got some sigmoid colon in it.

Now, under direct vision I'm going to close this off and make sure that I don't perforate the large bowel. But I will keep my finger on it to make sure that... that's it.

Hold onto that. That's the hernial sac gone... and then that just goes back in there.

I'm just going to close some of the cremaster here... tidy this up... from a technical surgical point of view I always think that it is nice to restore the anatomy back to as normal as you can.

C In response to the fentanyl that we gave, the breathing rate has decreased to 12 per minute and this is reflected in the end-tidal CO₂ trace which gives an end-tidal value of 46.7 mm Hg which is entirely acceptable.

Simultaneously the heart rate has decreased to 51 indicating that we have suppressed the original response to the noxious stimulus.

S I think where you have a thick cord like this, the last thing that you want to do in a young man, in particular is to compress the cord and make the testicle atrophy.

So I specifically made quite a **big hole in the mesh** for the cord to sit in.

See that blue stitch just there... it has got the mesh stitched into the inguinal ligament.

We are going to repeat that process on the other side of the mesh to the conjoint tendon.

What you are doing is that you are just placing the mesh which acts as a scaffold for some fibrosis, without pulling the conjoint tendon down onto the inguinal ligament which is of course one of the standard ways that it used to be done, and is the method described by Bassini in the 19th century.

I don't pull this tight... this is just to take up the slack....

As you get back here.... one actually has two arms of the mesh, because they have been separated.

The posterior bit has a hole in it there to allow for the cord and it is like leaving it with two arms.

Having done this, we are now in a position to be able to get the next bit absolutely right to make sure that there is not too much encroachment onto the cord.

Okay... cut that... thanks. And there we have it.

You see there is the **mesh without any tension**.

I've got onto the conjoint tendon, onto the inguinal ligament, behind the cord but not compressing it. It's cut out so it is just up to there... leaving plenty of room for what is quite a large cord, and right up to the medial part there where it is stitched to the inguinal ligament.

This is now the external oblique and we are just reconstituting this.

This doesn't actually make any difference to the strength of the repair, and one could say well why bother reconstituting this, but you want to keep the cord covered.

- C Once of the features of this anaesthetic is that despite the fact that the patient is a known hypertensive and on anti-hypertensive drugs, he has not demonstrated a hypotensive response to the anaesthetic induction, nor has he shown exaggerated blood pressure responses in response to the surgical stimuli.
This set of tracings here which are the blood pressure records during this anaesthesia show a very slight increase at the beginning of surgery and a good response to the fentanyl that we gave at that point and basically the blood pressure has remained very stable throughout.
- S This is just a **subcuticular stitch**. It lies under the skin and dissolves by itself.
The advantage is that you... *I'm just going to put in some local anaesthetic...* the advantage is that you don't have to make special arrangements to have the stitch removed... it is perhaps not quite so suitable for surgery you know is going to have a high risk of infection because it is more difficult for pus to get out.
Now I am just going to bury the knot under the skin... and that is it.
- C Before we remove the laryngeal mask we need to just give a **suck out of the pharynx** to make sure that there is no fluid above the laryngeal mask which might be inhaled on removing the mask. And at that stage we release the cuff..... and slide the tube out.
He is tending to bite on it a little bit at this stage.
And he is breathing well and he is going to be satisfactory to return to the recovery room in a very short while.
Okay... ready to roll?
A one, two, three.
Okay... a one, two, three.
And he is beginning to wake up.
- C Hello Damon, can you open your eyes for me?
Well done, operation is all finished.
- D (mumbles)
- C Yes, all finished.
- D (mumbles)
- C We are just going to give you some oxygen to breathe.
There we go... that's fine.
Just relax there.
Okay can you take him through now please.
- C Okay Damon, how are you doing?
- D Fine
- C It's ten minutes since the end of the operation and you seem pretty good to me.
Are you comfortable?
- D A bit of pain.
- C A little bit of pain?
- D Yes.
- C Have you had anything for that yet?
- D Not as far as I know.
- C No, well we will give you something for that to make sure that it doesn't get unacceptable.
The blood pressure is up a little bit, but that is nothing to worry about at this stage, and when you take your drugs this evening it will keep you under control as they do normally.

Discussion

- DCA Cedric, can we first talk about the **maintenance of the airway** in these two patients?
- CP-R In the first patient who had the thyroid lobectomy there was potential surgical interference with the airway, in that the surgery surrounds the trachea.
And it is absolutely essential that we maintain a stable airway, and that means placing an **endotracheal tube**.
In the second case the surgery was well away from the airway and the surgery was relatively minor, and required a different form of anaesthesia.
And we therefore elected to use a **laryngeal mask**.
- D And presumably in the second patient the fact that you were **adding a local block** meant that you could maintain lighter anaesthesia and therefore allow the patient to continue to breathe.
- C Yes, that is absolutely true.
- D Now the question of muscle relaxation.
The first patient had a curare-like drug, and the second didn't.
What are the **principles required in the use of muscle relaxants** at that time?
- C Well we used atracurium, a curare-like muscle relaxant for the first patient.
And this was purely to enable us to place the endotracheal tube in position.
We don't need muscle relaxation for thyroid surgery per se.
We would need muscle relaxation for intra-abdominal or intrathoracic surgery, but surgery of the neck doesn't specifically require it.
- D So is that agent a relatively short-acting agent?
- C It is a relatively short-acting agent.
It lasts about 20 to 30 minutes, and we were in effect simply allowing the effect to wear off during the surgical procedure.
- D For an **analgesic you used fentanyl**.
What is the reason for that, what are its advantages?
- C Well the advantage of fentanyl is that first of all it is a very potent drug.
It has a **relatively long duration of action**, at least as long as that of morphine, but it is a drug that is lipid soluble and therefore it redistributes from the blood into the fat of the body and that acts as a sort of sump, releasing the drug slowly over a long period of time in the postoperative period.
- D So in both cases there was local infiltration of local anaesthetic which seemed to be very effective.
- C Yes, the surgeon tends to, certainly in the thyroid, he tends to infiltrate the superficial layers of the wound with a quarter per cent bupivacaine and this provides again a long-lasting local anaesthetic effect so that when the patient wakes up they don't feel as if they have had a cut in the throat.
- D Turning to the **anaesthetic agents themselves**. What are the different agents that you use nowadays, and specifically the ones that we saw used in this film?
- C Well we've used two agents in this film.
For the thyroid surgery we used sevoflurane, a relatively new anaesthetic.
And for the patient with the hernia we used isoflurane.
And these are relatively modern anaesthetics.
They are fluorinated ethers and they are derived if you like from the original diethyl ether which was one of the first anaesthetics ever used.
- D Right.
- C The disadvantage of the diethyl ether which is a very good anaesthetic is that it is highly inflammable and in an oxygen-rich environment it explodes!
- D Right.
- C Therefore it is not terribly suitable for use where the surgeon wants to use diathermy.
- D Right. And is **halothane** still used at all?
- C Yes, halothane is still used all over the world, it is still a very safe anaesthetic.
It is more widely used at the moment where cost is a very major consideration in determining which agent you would use. We use agents which are rather more expensive, but we **use them in circle systems** and that enables us to be economic in the way that we use the anaesthetics because the anaesthetic is recirculated breath by breath around the circle and the patient is rebreathing this system all the time.
- D And these newer agents, are they associated with the risk of or be it rare with halothane of liver damage....?

- C No, they are **much less likely to cause liver damage**, and the reason is again as I mentioned they are much less metabolised. Halothane... 20 per cent of any halothane taken into the body is actually metabolised, whereas with a drug like isoflurane for instance only 0.2 per cent is metabolised.
- D Right.
- C Sevoflurane is slightly more metabolised, but they are nevertheless very stable compounds and they provide very safe anaesthesia.
- D What about the **agents that you use for induction of anaesthesia**?
- C Well in both cases we used propofol following a dose of fentanyl. By giving the fentanyl first we induce the analgesic component and ensure that that is present at the time that we want to either intubate the patient or put a laryngeal mask down.
- C And we follow that up with propofol. **Propofol is an intravenous anaesthetic.** It has many of the properties of the volatile anaesthetics, but we give it through a vein and it gives a very pleasant induction for the patient.
- D And it is not suitable for maintenance presumably?
- C Oh yes it is. Yes it can be used as a continuous infusion in what we call total intravenous anaesthesia. And again it would need to be supplemented by either an opioid or with some other regional anaesthetic technique.
- D Well finally turning to the medical aspects of these cases.
I think the first lady you checked the recurrent laryngeal nerves that had already been checked by the surgeon... but what did you do on the way out so to speak?
- C Well all I did was to view the vocal cords as I extubated the patient and checked that both cords were working and closing simultaneously which simply means that the recurrent laryngeal nerve on the side that has been operated on was still functioning properly.
- D Right. So she was breathing spontaneously at that time?
- C She was breathing spontaneously and swallowing at that time.
- D And then our second patient with the polycystic kidneys and hypertension.
What is the importance of getting good control of blood pressure before surgery in such a patient?
- C Patients who have hypertension, particularly **uncontrolled hypertension, show exaggerated responses to surgical stimuli** which may cause very marked sympatho-adrenergic responses. And because hypertension is very largely associated with ischaemic heart disease because they occur in the 50 to 70 year old age group, then this tends to provoke ischaemic changes in the myocardium which may be deleterious to the patient.
- D Right So in a young man such as this, it perhaps might be a bit less important?
- C Yes much less important in this chap.
But patients who have renal hypertension usually have fairly severe hypertension, although this chap was very well controlled indeed on the combination of drugs that he was receiving.