

CTC BOWEL INSUFFLATION BY RADIOGRAPHERS



MODULE 4: TECHNIQUE

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OUTLINE

- Module 1: Course requirements
(Protocols/Logbook/Supervisor)
- Module 2: Anatomy, indications, risk factors
- Module 3: Equipment & Preparation
- **Module 4: Technique**



LEARNING OUTCOMES

- To become familiar with best practice techniques for the performance of rectal intubation and insufflation
- To understand the necessity to monitor the patients pain as well as the insufflator pressure and volume throughout the examination
- To know how best to achieve optimal distension of the colon and problem solving techniques
- To be familiar with manual insufflation when required

MODULE 4



Technique



PRIOR TO COMMENCEMENT

Ensure the following have first been done

- Assemble & prepare equipment
- Give full explanation to patient
- Obtain consent
- Change patient into gown and check bowel preparation
- Obtain patient history (to identify risk factors)
- Lie patient in lateral decubitus position



PREPARE TO INSERT CATHETER

- Lubricate the catheter tip by putting some jelly on a piece of gauze and applying the jelly to the catheter tip.
- If the patient has tenderness or hemorrhoids, you may spray some lidocaine on the jelly (if agreed as part of local policy)
- Some departments carry lidocaine jelly as well. Lidocaine jelly is often included in Foley catheter insertion kits or packaged separately.



INSERTION OF CATHETER

- Patient lying either left / right side, back towards insufflation machine
- Inspect anus for haemorrhoids or other lesions that require cautious insertion
- Avoid force during the flexible catheter insertion, but gently introduce the catheter.



INSERTING CATHETER

- Now ask the patient to take deep breaths as you insert the tip of the catheter into the patient's rectum.
- Another method used by some is to ask the patient to bear down (valsava maneuver), then relax. This allows the tube to go in easily.
- After insertion and balloon inflation, pull back gently to ensure it is snug on inside of anal verge



INSERTING CATHETER

- Secure catheter in situ
- **No balloon:** tape catheter near the anus
- **Balloon:** preferably filled with air instead of fluid (With air an indentation of the catheter by a polyp can be appreciated while it will be obscured when using water for balloon insufflation)



INFLATING BALLOON CUFF

- Use is **OPTIONAL**
- Advance the tubing well into the rectum before inflating.
- Inflate the balloon cuff to 20 cc initially to promote retention on all patients.
- If patients indicate they have poor rectal tone (e.g., they had trouble retaining rectal contents on a prior barium enema or virtual colon exam, or simply state that they think they have poor rectal tone), then the balloon may be inflated with a larger volume, e.g, 30 cc. Optionally, larger balloons may be used if available.
- **Patient should not feel it!!**
- Remove syringe from luer lock



QUIZ QUESTION

If a patient has a very tender anal verge, the best way to put in the rectal catheter is:

- ☐ Do not. Just call the radiologist
- ☐ Push the catheter in very quickly, so it will hurt less
- ☐ Use lubricant and if possible, add lidocaine
- ☐ Use a very small catheter



ASSESS FLUID DRAINAGE

- You are almost ready to start insufflation, but you decide to assess fluid drainage from the rectum first.
- No fluid in the tubing: CONTINUE.
- *Fluid in tubing:* guide all of the fluid into the fluid collecting bag until all the fluid has drained into the bag, then you may continue. A large amount of fluid in the tubing can hinder the flow of CO₂.

CONNECT ADMINISTRATION SET



- You proceed to connect the administration set connector into the port on the front panel of the insufflator.
- Push firmly to connect tubing





QUIZ QUESTION

Regarding the balloon on the rectal catheter for CT colonography:

- ☐ It is best to avoid blowing up the balloon at all
- ☐ Blow up the balloon with the entire volume of the syringe provided in the kit
- ☐ Only use about 15cc to blow up the balloon even if the syringe is larger
- ☐ If you use tap, the balloon is not needed

START FLOW OF CO₂

- Start the flow of CO₂ by pressing the flow Stop/Run button.
- The button should be illuminated with a green light when on. Watch the volume start to increase.





TURNING PATIENT

- Patients who are sufficiently mobile might benefit from a "turning manoeuvre" to distribute the gas in the colon. It may be omitted on immobile patients such as those with severe arthritis, hip replacements or the morbidly obese.
- As the volume increases to 0.8L, you guide the patient in doing the "turning manoeuvre" to distribute the gas.
- Roll the patient from right decubitus → prone → left decubitus → supine.
- No evidence that order of positioning influences bowel distension
- Note: During the turning maneuver pay attention to the tube so that it does not slip out of the patients rectum.

INSUFFLATION POSITIONS



ASSESSING PAIN: NONE REPORTED



- As volume continues to increase, ask the patient about their pain level.
- Some patients may be in pain but not say it. If the patient reports no pain, check for signs of pain, e.g. grimacing or wiggling toes, and encourage the patient to be forthcoming.
- If the patient still reports no pain and does not show any signs of pain, you can continue to assessing pressure and volume of gas administered. But first, let us review the proper procedures when pain is reported.



ASSESSING PAIN: SOME PAIN

- If patient reports pain, ask
- *What is your pain level. Is it mild, moderate or severe?*

- If the pain is **'Severe intolerable'**
- STOP insufflation.
- If the pain is brief and subsides, you may attempt to continue. If it is prolonged or persistent, you should consult with the radiologist about possible administration of buscopan/glucagon for decreasing spasm and/or increasing comfort.
- Perform a scout view if pain is intractable to see if there is a point of obstruction visible. For example, if the rectum and sigmoid are distended with gas, there might be an obstruction in the distal descending colon. In that case, it would be appropriate to proceed with a supine only scan to document the obstruction and look for its cause.



ASSESSING PAIN: MODERATE

- If pain is 'Moderate':
 - Encourage the patient to continue to tolerate the pain as you continue insufflation.
 - ▣ breathe through his/her mouth.
 - ▣ Instruct to relax his/her abdominal muscles during the procedure.
- If the pain stays mild or moderate, you may continue to assessing pressure and volume of gas



ASSESSING PAIN: MODERATE

- Flow of CO₂ may be paused by pressing the FLOW STOP/RUN button to allow time for the colon to relax.
- Once the patient is comfortable, the flow can be re-started by pressing the FLOW STOP/RUN button again.
- For patients who require more gradual insufflation, the pressure of CO₂ may be lowered (15 to 20 mm Hg) by using the Pressure Adjust Dial to allow for a more gradual distention of the colon. When the patient is comfortable, the pressure should be slowly raised to 20-25 mm



SPASM

- Pressure may go high if patient is having a spasm
- To reduce pain – a deflation manoeuvre can be done
 - Turn off flow, by hitting green button
 - Remove the tubing from the pump
 - Pump will read room air and the pressure will drop to ZERO
 - Tubing can be reattached and the pressure will stay close to ZERO



INGUINAL HERNIAS

- Specific attention needed to left groin in patients with known pre-existing left inguinal hernia during insufflation
- Palpation necessary to evaluate distension & ask patient to report any symptoms
- Discontinue insufflation if hernia sac increases in size



QUIZ QUESTION

If a patient reports severe intractable pain during the early phase of insufflation, the first thing to do is:

- a) Stop the flow of gas
- b) Scan immediately
- c) Wait 5 minutes and then continue
- d) Call the radiologist for help



ASSESSING PRESSURE

Is the pressure constant?

- Is it consistently varying only by about ± 2 mmHg around the set point (usually 25 mmHg)?
- **1) No** the pressure is above the set point
- If the pressure is constantly above the set point, there might be kinks, closed clamps or blockages.
 - Check the administration tube and check for any obstructions.
- No kinks, closed clamps or blockages:
 - If pressure continues to be high and there is no blockage, you should proceed and do a scout scan.
- Yes there is a kink, closed clamp or blockage
 - If after fixing the obstruction, the pressure is still above the set-point, then you should proceed and do a scout scan.
- If after fixing the obstruction, the pressure is now constant, then you may continue insufflation



ASSESSING PRESSURE

- If constantly **below** the set-point, you should try the bag manoeuvre.
- This uses the fluid collection bag as though it were a puffer to manually add gas to the colon.
- The bag manoeuvre should only be used if the patient is not in extreme pain and the bag is not rock hard
- Squeeze bag while pinching off tubing between insufflator and bag to ensure air goes towards catheter



ASSESSING PRESSURE

If pressure is **CONSTANT**

- Continue insufflation until the volume gets to 2L or more.
- As you continue to insufflate, you assess the patient's pain while monitoring the volume.



PAIN / VOLUME

If patient has pain

- YES (volume below 2L)
 - ▣ assess the volume of gas in the colon to decide if you are ready to take a scout scan.

- NO
 - ▣ If the patient does not report any pain, or if the patient reports pain and the volume is at least 2L, you may continue insufflation.



IS VOLUME INCREASING

- If the colon is optimally distended, CO₂ should go in at a slower rate since it is "full" and pressure exceeds 25 mmHg.
- *If the volume is increasing slowly or not at all, then you are ready to do a scout scan.*
- *If the volume is still going in at a moderate rate, then you should continue insufflation and assess distention.*



OBSERVATIONS DURING INSUFFLATION:

Lower than expected volume of CO₂

A stabilized volume of <2 Liters of CO₂ in the initial scanning position may indicate incomplete distention of one or more colonic segments. If this occurs, perform the following steps:

1. Roll the patient onto either side to redistribute the CO₂ in the colon.
2. Raise the pressure to 25 mm Hg.
3. A drop in the pressure as indicated on the pressure display on the front panel will indicate the opening of the segment in question, and will be accompanied by an increase in the volume of CO₂.
4. Continue with the rolling manoeuvre until the volume reaches at least 2 Liters.



OBSERVATIONS DURING INSUFFLATION:

Higher than expected volume of CO₂

If the volume pauses at 4 Liters, one of the following conditions may be present. A scout image should be taken immediately to evaluate.

- a. **Pneumoperitoneum** – If free intra-peritoneal air is observed, or if colonic perforation is suspected, immediately discontinue insufflation by disconnecting the administration set from the insufflator. Provide appropriate medical attention.
- b. **Small bowel reflux** – If reflux is evident and distention is acceptable, proceed with study. If additional CO₂ is required, it may be added by depressing the FLOW STOP/RUN button, under the supervision of a physician. If small bowel reflux is observed, completing the study as quickly as possible will help to minimize the reflux.
- c. **Leakage around rectal tube** – If the colon is not fully distended, and no small bowel reflux is evident, it may be due to leakage around the rectal tube. If not already inflated, consider inflating the rectal balloon on the rectal tube. In addition, ask the patient to squeeze his/her muscles to retain the rectal tube.



HOW MUCH GAS?

- No defined optimum level
 - ▣ Varies according to patient size / previous surgery
 - ▣ Manual (1.5-2L) vs Automated (median 4.2L)
- No research on optimal positions for insufflation
- Perform scout after reaching 3L, but at least 5-6min after starting insufflation
- Incompetent ileocaecal valves may allow larger volumes to be administered



QUIZ QUESTION

Most patients require ___ Liters of gas as a minimum before adequate distention is achieved.

- a) One
- b) Two
- c) Three
- d) Four



OPTIMAL DISTENSION

- You continue insufflation and you ask the patient:
- Do you feel cramping, a sense of fullness or mild discomfort?
- **YES:** means that the colon is distended and you are ready to do a scout view.
- Check the volume again to see if it is above 2L since most colons require 2L or more of CO₂.



OPTIMAL DISTENSION

- *If the volume is below 2L, the patient might have a small colon (or gas or air filled colon from natural causes). You can continue insufflation for a little while and then obtain a scout view. Note that infrequently a CT colonography is done on the same day after an incomplete optical colonoscopy. In that case, there might also be air or gas filling the colon from the prior procedure.*
- *If the volume is above 2L, you are ready to obtain a scout view.*



QUIZ QUESTION

The key reason to assume the colon is probably distended before obtaining a scout view is the combination of:

- a) Moderate pain and $>2\text{L}$ of gas insufflated
- b) No pain and more than 3L of gas insufflated
- c) Mild pain and 1 L of gas insufflated



CONTINUE INSUFFLATION UNTIL 4L

- If the patient does not feel any cramping, fullness or discomfort, you should continue insufflation for a few minutes until either:
 - ▣ The volume reaches 4L
 - ▣ The patient reports cramping, fullness or discomfort
- As a precaution, the insufflator automatically shuts off at 4L and every 2L afterwards. If the volume reaches 4L and the patient still does not report any discomfort, you should assess leakage of gas per rectum. Also check that the tube has not pulled out from the rectum.
- If a large volume of gas (e.g., 4L) has NOT leaked out from the rectum, yet the patient has no pain or only mild discomfort, then you should suspect marked reflux of gas into the small intestine. This is caused by an incompetent ileocecal valve and is not uncommon in older patients.



ASSESS LEAKAGE

- Since the volume is at least 4L, there might be leakage at the anus OR there might be small bowel reflux.
- Check to see if there is leakage. Ask the patient if they feel gas coming out per rectum. Listen for that as well. (However, the extent of small bowel reflux can only be assessed on the CT Scout).
- *YES – Leakage*: fix the leakage by slightly pulling the rectal catheter with retention balloon back to the anal sphincter for tight closure of the anal opening. If the catheter comes out, then reinsert it and use a larger volume of air to distend the balloon cuff.
- *NO leakage at the anus*, proceed to assessing small bowel reflux.

SMALL BOWEL REFLUX

- Perform scout view to assess
- May be difficult if bowel loops overlap





SMALL BOWEL REFLUX

- **NO small bowel reflux:** continue insufflation under the supervision of the radiologist/physician.
- **YES small bowel reflux:** continue to assess colonic distention.
 - If the colon is still under-distended, keep insufflating and follow the prior guidelines based on pain level.
 - If you are unsure about the colon because there is so much small bowel gas, then proceed with the scan but keep the gas flowing.
 - If the colon is well distended, proceed with the scan.



COLON DISTENSION

- Should be sufficient to visualise all colonic segments in at least one position, ideally both
- Volume of gas administered does not alone indicate adequate distension
- Optimum differs between individuals and should be judged taking into consideration colonic pressure, patient tolerance and appearance on scout
- Check distension on scout image in both positions prior to full data acquisition

OPTIMAL DISTENSION

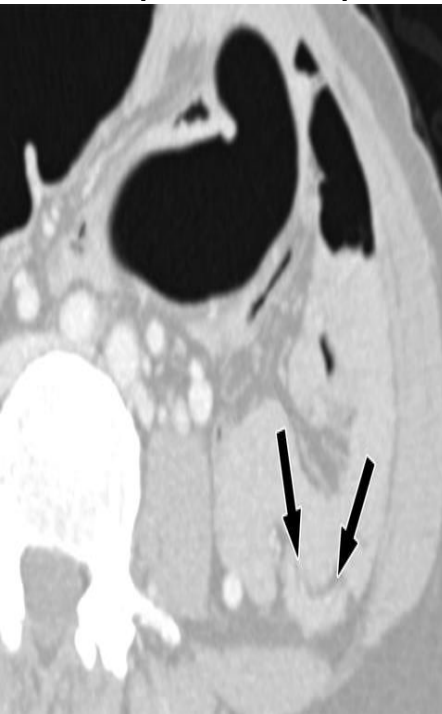
- Assess scout scan
- Ensure entire colon distended – no collapsed segments
- May decide to continue insufflation



OPTIMAL DISTENSION

- Ideal: colonic wall to be pencil thin throughout with thin haustral folds $< 2\text{mm}$ thick throughout

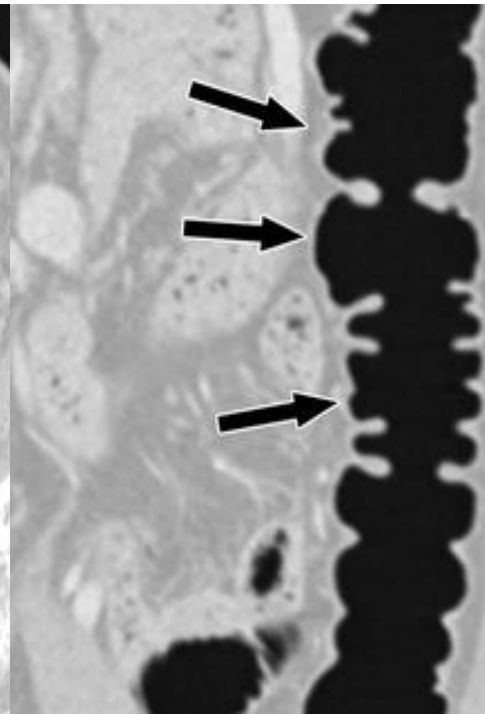
Complete collapse



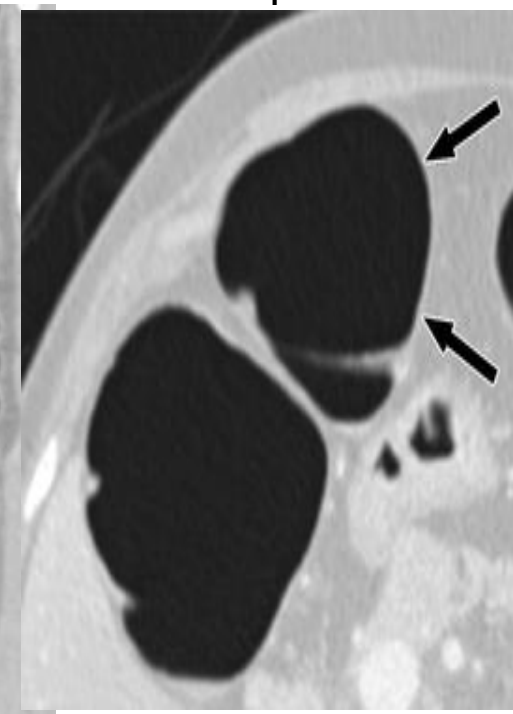
Partial collapse



Reasonable



Optimal





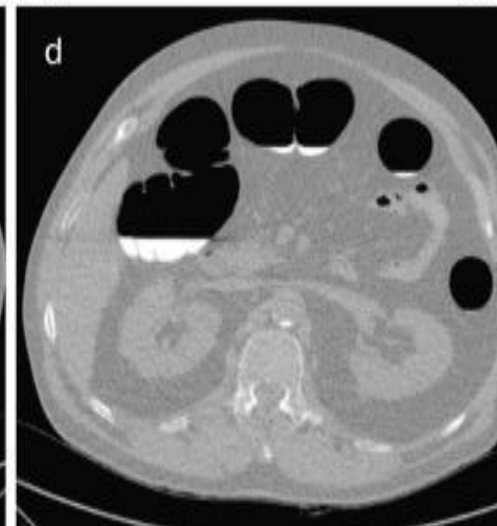
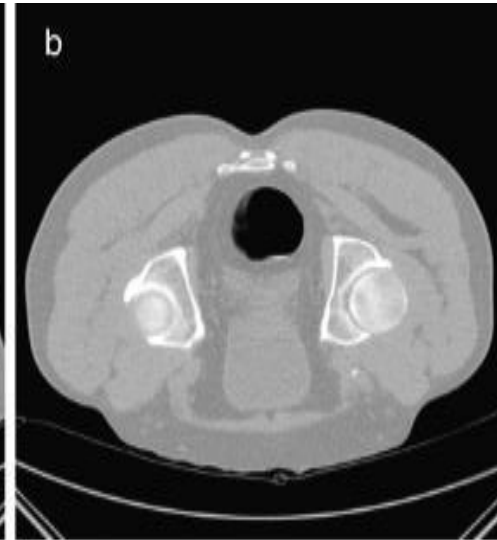
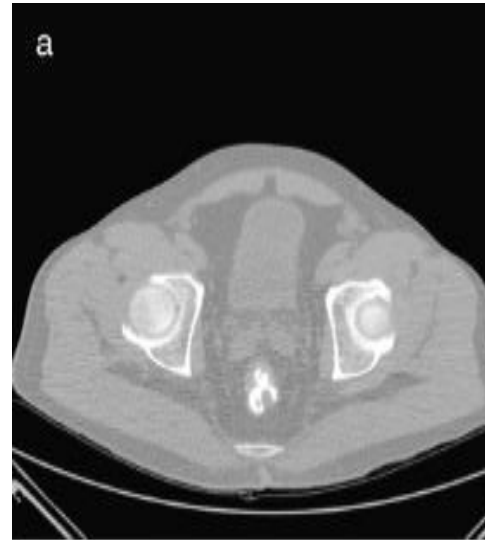
COLON DISTENSION

- Distension differs per segment depending on patient position
- Supine: rectum often collapsed, optimum distension of ascending and transverse colon
- Prone: transverse colon often collapsed, optimum distension of descending and sigmoid colon
- Sigmoid most often collapsed – requires careful scrutiny

COLON DISTENSION

Differences supine v prone

- (a) collapsed rectum in supine position
- (b) good distention in the same patient.
- (c) collapsed transverse colon (arrow) and
- (d) good distended transverse colon in the same patient





PATIENT POSITION

- **No IV:** start with supine
 - ▣ More comfortable for patient & easier to communicate

- **IV:** start with prone – allows radiologist to interpret the supine scan with contrast easier

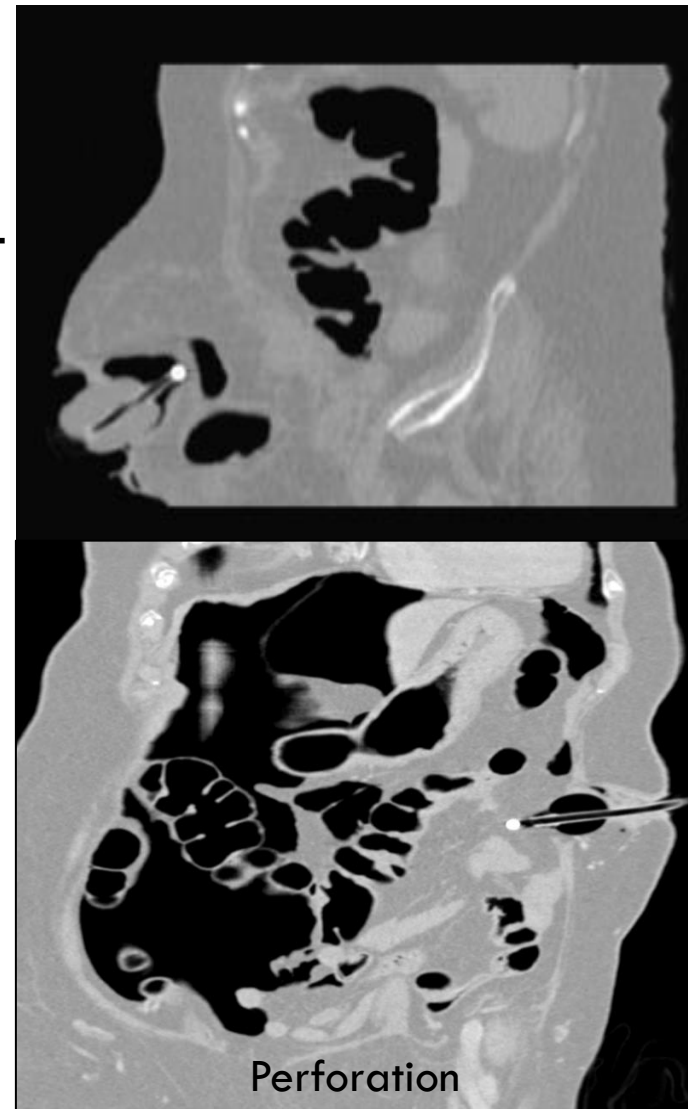
PATIENT POSITION

- During prone – place pillows under patient thorax to reduce compression of transverse colon
- If patient unable to lie prone – lateral decubitus is a good alternative



COLOSTOMIES

- Not absolute contraindication
- Use balloon tip catheter to prevent air leakage and hold catheter in place
- Needs careful introduction and balloon insufflation – avoid perforation
- Digital exam can be performed





QUIZ QUESTION

True or False: Reflux into the small bowel should be suspected when the patient has little or no discomfort, yet $>4\text{L}$ of gas have been pumped and there is no evidence of leakage of gas from the rectum.

- ☐ True
- ☐ False



MANUAL INSUFFLATION

- In some scenarios where the colon is not getting adequately distended, you may be required to switch to manual insufflation. This should be extremely rare for users of the mechanical insufflators.
- E.g.: when the patient continually reported no pain in response to insufflation.
- To switch to manual insufflation:
 - Clamp the tube to prevent escape of gas from patient's colon.
 - Shut off the machine and disconnect the tube from the machine.
 - Cut off the tip that clips to the machine with scissors.
 - Force a manual insufflation bulb (blue puffer) into the end of the tubing.
 - Unclamp the tube and proceed with slow manual insufflation of room air.



MANUAL INSUFFLATION

- Modify barium bag to allow manual insufflation with puffer (inexpensive)
- Take single contrast enema bag, discard tip and bag and create lengths of tubing approx 30cm long
- Attach puffer on one end and enema tip to other



ASSESS CRAMPING

- As you proceed with slow manual insufflation, you ask the patient if she has any cramping.
- *If the patient reports cramping*, slow down or stop pumping temporarily. Continue pumping until about 50 puffs or until the patient reports constant moderate pain.
- *If the patient reports no cramping*, ask about the patient's pain level.



NO PAIN

- Continue pumping until about 50 puffs and the patient's pain has increased to constant and moderate pain. At this point, you are ready to take a scout scan.
- *If the scout view does not show sufficient distention, continue pumping until about 60 puffs then reassess pain and cramping until the patient is ready for a supine scan.*
- *If the scout view shows adequate but not optimal distention, pump additional air (about 10 puffs) immediately before scanning, and then proceed with the supine scan.*
- *If the scout view shows optimal distention, you are ready to do a supine scan.*



CONSTANT / MODERATE PAIN

- This is usually an indication of adequate/optimal distension, especially if you have already put in about 50 puffs of air. At this point, you should stop pumping and obtain a scout view.
- *If the scout view does not show sufficient distention, continue pumping until about 60 puffs then reassess pain and cramping until the patient is ready for a supine scan.*
- *If the scout view shows adequate but not optimal distention, pump additional air (about 10 puffs) immediately before scanning, and then proceed with the supine scan.*
- *If the scout view shows optimal distention, you are ready to do a supine scan.*



SEVERE PAIN

- The patient reports severe pain, so you decide to try the "3-second deflation manoeuvre"
- Disconnect the tubing for 3 seconds to reduce the pressure and then plug it back in.



QUIZ QUESTION

When using manual insufflation, if a patient has very severe pain that will not go away after giving about 30 puffs of air, the best thing to do is:

- a) Call the radiologist to administer a drug to relax the colon (e.g., buscopan / glucagon).
- b) Cancel the exam, it hurts too much.
- c) Take out a little air and do a scout view.
- d) Stop and do a scout view ASAP.



ONCE SCANNING COMPLETE

- Discontinue Flow of CO₂ and Disconnect Tubing
- If illuminated, press the flow Stop/Run button to discontinue the flow of CO₂. Then, disconnect the tubing from the front panel of the insufflator or blue puffer.
- Do not disconnect the tubing from the patient just yet.
- **NOTE: Be careful to use different gloves to touch the machine and the patient.** Otherwise, the machine could become contaminated.

ONCE SCANNING COMPLETE



- If the patient is in the prone position, remove the pillows from under the patient's chest.
- If a pillow was used for the legs, that can be removed as well.
- Allow the tubing to remain in the patient's rectum for 30-60 seconds so gas can be expelled. Any pain or discomfort should be relieved.



REMOVE TUBING

- After allowing the tubing to remain in for 30-60 seconds, now you can:
- Use the syringe to deflate the enema tip cuff or balloon (if used and if you did not already deflate it before the prone scan).
- Gently remove the tube from the patient.
- Close the yellow slide clamp.
- Wipe the jelly from the rectum with a soft tissue.



ASSESS PATIENT

- **Physically** for any dizziness or vasovagal symptoms (weakness, vision disturbances, sweating, nausea, fainting)?
 - *If present*, let the patient lay down for a few minutes to recover. If the patient does not recover or faints, get help immediately by calling your hospital or clinic's emergency number.
 - *If no symptoms*, you can continue. Sit the patient up and check again for the above signs. If none, you may stand the patient up and escort them to the toilet.
- **Radiologically** for signs of perforation



CLOSE THE CO₂ TANK

- Allow the patient to sit up and stand. Assist the patient if necessary.
- Send the patient to the toilet.
- Inform of aftercare and when results will be available.
- Close the CO₂ tank using the provided wrench. This is important because slow leakage of CO₂ in between usages can drain the tank.



QUIZ QUESTION

The first thing to do after completing the final scan is:

- a) Unplug the insufflator.
- b) Reconstruct the images and send them to the workstation.
- c) Sit the patient up and check that the patient is not dizzy.
- d) Quickly remove the tubing from the rectum.
- e) Stop the flow of gas, deflate the rectal balloon and disconnect the tubing from the insufflator only.



QUIZ QUESTION

A CT colonography should be rescheduled and rescheduled if

- a) The patient is having some tiny particles of solid stool
- b) The patient forgot to drink the tagging agent
- c) The patient forgot to drink the colon cleansing agent but has no urge to empty the rectum
- d) The patient refuses to sign a consent form



CT SCAN PARAMETERS

ESGAR advise

- ≥ 4 row MDCT needed
 - Entire abdomen needed on single breath hold with narrow collimation
- Thin slices (slice thickness $< 3\text{mm}$)
- Reconstruction overlap of 20-30%
- Cranio-caudal direction to minimise breathing artefact
- Dose modulation and iterative reconstruction used where available
- No IV: $< 50\text{mAs}$ (except for overweight pts)



- Ideally Radiographers should perform a minimum number of examinations per year to maintain competency
- Include within local protocols
- Also consider audit of procedures (success / complication rate, scan times, etc)



SUMMARY

- Careful insertion of catheter
- Consider use of balloon cuff to secure in situ
- Insufflation requires careful monitoring of patient and equipment to ensure optimal distension
- Assess patient pain, CO₂ volume and CO₂ pressure throughout (+ palpate inguinal hernia if present)



GUIDELINES

- Royal College of Radiologists (2014). Guidance on the use of CT Colonography for suspected colorectal cancer. .
- ESGE - ESGAR (2014). Guidelines on indications for CT colonography
- ESGAR (2015). 2nd ESGAR consensus statement on CT colongography
- NICE (UK) CT colonography
- ACR–SAR–SCBT-MR (2014). Practice parameter for the performance of computed tomography (CT) colonography in adults