

## Standard Operating Procedure: Rectal barostat

After an overnight fast, the subjects present to the laboratory at 7.30 a.m. They receive a cleansing tap water enema (750mL) and after bowel emptying, they are placed in a left lateral decubitus position in a hospital bed tilted by 15°. Put a pillow between legs and offer several pillows to go under the head to make patients more comfortable. A rectal barostat catheter with a polyethylene bag attached will be inserted into the rectum so that the middle of the bag is located approximately 10 cm from the anal verge, and the barostat catheter will be taped to the buttocks. The catheter is to be inserted following lubrication of the catheter and barostat bag with KY jelly (or similar non-anesthetic lubricant). Digital examination may be performed for catheter insertion, but is not strictly required. No endoscopic insertion aids are to be used for catheter placement. The barostat bag is then unfolded by transiently inflating it with 75 mL of air and subsequently deflating it completely but leaving it *in situ*. Flow rate for barostat inflations 32 ml/s.

After a 20–30 min recovery period, the catheter is connected to a barostat and the pressure in the bag increased from 4 mmHg in steps of 1 mmHg for 1 min per step until respiratory excursions are observed. The baseline operating pressure (BOP) is defined as 2 mmHg above the minimal distension pressure at which respiratory excursions are clearly recorded from the barostat tracing. If respiratory variations are not seen by 18 mmHg, BOP is set at 12 mmHg. Next, an initial “conditioning” distension of the rectum will be performed in which the pressure is increased from 0 mmHg to 20 mmHg in steps of 4 mmHg for 15 sec per step. Subsequently, the bag is deflated to 0 mmHg but left *in situ*, and the patients are allowed to rest for 10 min before proceeding to the ascending method of limits (AML) protocol.

### Ascending Method of Limits (AML) protocol

Sensory pressure thresholds and colorectal compliance will be measured by ramp inflation, starting at 0 mmHg and increasing in steps of 4 mmHg for 1 min per step to a maximum of 60 mmHg. Thresholds for first sensation, first desire to defecate, urgency, discomfort and pain will be indicated by the patients by pressing a button at the distension pressure at which sensations are perceived. Ramp inflation is terminated as soon as the patients report the first sensation of pain. Following this procedure, the bag is deflated to BOP and left *in situ*, and the patients are allowed to rest for 10 min, then the random phasic distensions (RPD) protocol will be conducted.

### Random Order Phasic Distensions (RPD) protocol

Phasic distensions of 12, 24, 36 and 48 mmHg above BOP will be each applied once in a random order. The maximum pressure to be used for RPD is limited by the pain threshold from the previous AML, so that only the next higher pressure should be applied for RPD (e.g. if pressure threshold in AML is 30 mmHg above BOP, use 12, 24 and 36 mmHg above BOP, but not 48 mmHg above BOP). Each distension will be maintained for 60 sec with an interstimulus interval of 2 min during which the bag is deflated to BOP. The subjects will rate the intensity of four different sensations during the last 30 sec of each distension (gas, urgency, discomfort and pain).

### Outcome variables:

- The sensory thresholds for first sensation, first desire to defecate, urgency, discomfort and pain during AML; i.e., the barostat pressures [mmHg] at which the patients press the button to signal perception of the corresponding sensation, and the corresponding balloon volumes (ml).
- The aggregate sensation intensity scores for gas, urgency, discomfort and pain in response to the four random phasic distensions during RPD (12, 24, 36 and 48 mmHg above baseline operating pressure (BOP)); i.e., the visual analogue scale (VAS) scores [mm] marked by the patients at each distension.
- Colorectal compliance, summarized as the distension pressure  $Pr_{1/2}$  [mmHg] at half of the maximum observed volume of the barostat bag during AML. A pressure-volume curve will also be created during the AML distension (balloon volume during the last 10 sec of each pressure step).

**Definition of sensations to be recorded during AML and RPD**

Patients will be given instructions separately before AML and RPD. During the AML there should be no interaction between operator and patient, i.e. just let the patient select the AML sensation via the keypad as indicated in the script.

**NOTE:** For AML, sensations are to be reported if they occur immediately after balloon inflation. The 5 sensation pressure thresholds do not have to occur according to their numerical order. If any sensation buttons are not hit during AML, report sensation as greater than 60 mmHg.

For RPD, a prompt should be given approximately 30 seconds into the distension indicating that the subject should now complete the 4 VAS supplied by the operator for each distension.

If on the pain VAS the subject scores greater than 80mm, the distension is to be immediately aborted and no higher pressures are to be applied.

**NOTE:** Due to the AML-based cap to applied pressures, patients may not receive all 4 distension pressures. Please briefly instruct patients prior to each RPD session how many distensions to expect (may vary). Distensions are to be numbered consecutively, even if you skip distension(s) from the applicable randomization scheme (i.e. if you use 3 distensions, you will have distensions #1, 2 and 3; if you use 2 distensions, you will have distensions #1 and 2 only. Please cross out any omitted distensions on the randomization list to be part of the source documents).

**Definition of volumes for compliance calculations to be recorded during AML**

Volumes recorded for compliance should reflect average volume during the 2nd 30 sec period of each AML step reached during the procedure.

**NOTE:** This applies only for non-painful balloon distensions. For the last (painful) pressure exerted during AML, the following rules apply:

- a. If pressure applied for > 30 sec, average last 30 sec;
- b. If pressure  $\leq$  30 sec, average last 15 sec;
- c. If pressure < 15 sec, average last 5 sec if/where the volume has stabilized (<10% volume change)
- d. If none of the above applies, skip value and make a note

**Suggested patient script****On arrival outline the procedure to the patient**

- Today we will ask you some questions about your IBS and your bowel habits.
- We will then give you a saline enema to clean out the lower part of your bowel.
- One hour after this we will put the barostat catheter in place.
- You will be asked to lie on your left hand side with your legs bent. After a brief rectal examination the catheter will be eased gently into place.
- The catheter consists of a thin flexible tube with a polythene bag attached at the end. The bag will be inflated slowly with a little air and then deflated to ensure that it is lying correctly.
- After about 20 minutes we will start the barostat procedure. First of all only small amounts of air will be put into the bag till we have established the baseline. Then a “conditioning” step will follow, when the pressure in the bag will increase stepwise for 15 seconds per step.
- The bag is then deflated and there is a 10 minute rest period.

**Ascending Method of Limits****General guidance**

- During the next part of the test I will not be able to talk to you but I will give you full instructions beforehand.
- Increasing amounts of air will be put into the bag and you will be given a keypad to register the sensations that you feel. The air will then be removed and you will have a 10 minute rest.

**Instructions given before AML**

- This part of the study must be done with a minimum of interaction between you and me, so I will not be able to speak to you unless there is a problem.
- The bag will now be inflated with increasing amounts of air for 1 minute before going on to the next inflation. Here is a keypad with labelled buttons.
- We ask that you press these buttons when you first feel a particular sensation.
  - o First Sensation – press the first time you feel something different.
  - o First Desire to Defecate (pass a bowel movement) - press the first time you feel this desire.
  - o Urgency – press when you feel that you would have to stop what you are doing to have a bowel movement immediately.
  - o Discomfort – press if you feel discomfort.
  - o Pain – press if you feel pain.
- As soon as you press the pain button the inflations will stop and the bag will be deflated.
- You may not feel all of these sensations and you won't necessarily feel them in the order of the buttons. You will be given a card with the explanation for each button on to remind you of the sensations that we are asking about.
- It is important for you to know that although during this procedure/test you will feel that you need to have a bowel movement, you will not, as it is only the inflation of the bag that makes you feel the sensation.

**Random Phasic Distension (RPD)**

**General guidance**

- During this final part, the bag will be inflated to four different pressures in a random order with a short rest between each inflation.
- You will be given a score sheet to record your rating of what you feel.
- The tube will then be removed and you will be finished for this visit.

**Instructions given before RPD**

- During this section the bag will be inflated to four different levels in a random order.
- 30 seconds after the bag has been inflated I will hand you a sheet of paper.
- On the sheet there will be 4 lines: one for gas, one for urgency, one for discomfort and one for pain.
- We want you to mark on each line your sensation score for each of the different sensations, with no sensation on the left, going up to unbearable on the right.
- For instance if it felt like you had a lot of gas that needed to be passed you would put a vertical mark on the line far over towards the right hand side, corresponding to the level of gas you felt.

**1. Aggregate sensation intensity score for gas :**

*Please indicate with a vertical mark (|) through the horizontal line the aggregate sensation intensity score for gas in response to random phasic distension.*

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*Unnoticeable gas*

*Unbearable gas*

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**2. Aggregate sensation intensity score for urgency :**

*Please indicate with a vertical mark (|) through the horizontal line the aggregate sensation intensity score for urgency in response to random phasic distension.*

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*Unnoticeable urgency*

*Unbearable urgency*

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**3. Aggregate sensation intensity score for discomfort :**

*Please indicate with a vertical mark (|) through the horizontal line the aggregate sensation intensity score for discomfort in response to random phasic distension.*

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*Unnoticeable discomfort*

*Unbearable discomfort*

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**4. Aggregate sensation intensity score for pain :**

*Please indicate with a vertical mark (|) through the horizontal line the aggregate sensation intensity score for pain in response to random phasic distension.*

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*Unnoticeable pain*

*Unbearable pain*