Pulmonary Diagnostics: Methacholine Challenge Testing

Site Applicability

St. Paul's Hospital
Mount Saint Joseph Hospital

Practice Level

Respiratory Therapist

Policy Statement

Methacholine challenge testing is a method used to assess airway hyper responsiveness. When asthma is a serious consideration and pre/post spirometry has not determined a diagnosis, a methacholine challenge test is recommended.

During methacholine testing an emergency drug kit must be readily accessible and a Respirologist must be immediately available to attend to adverse reactions. The Respirologist will have responsibility for administering medications from the emergency drug kit (epinephrine, diphenhydramine, dexamethasone etc.) if required.

Need to Know

- A recent spirometry must be completed within 6 months prior to performing a methacholine challenge test.
- Methacholine should be at room temperature when used and stored in the ADC refrigerator when not in use. Any unused methacholine from testing should be discarded into the Stericycle and not disposed of into the sink.

Indications

- To assess the presence and degree of airway responsiveness in individuals presenting with respiratory symptoms; it is most often performed to exclude or confirm a suspected diagnosis of asthma.

Contraindications

- Absolute:
  - FEV1 less than 60% of predicted, or less than 1.5 L at baseline measurement
  - Recent MI or stroke within the last 3 months
  - Arterial Aneurysm

  - Aortic Aneurysm
  - Recent eye surgery or increased intracranial pressure
  - Uncontrolled Hypertension

- Relative:
  - Patient unable to produce reproducible results
  - Patient is pregnant or breast feeding
  - Current use of cholinesterase-inhibitor medication

Special Considerations

- The starting concentration of methacholine may be selected according to baseline spirometry and the response to the control inhalation
- Patients should refrain from consuming alcohol at least 4 hours prior to testing
- Patients should refrain from smoking/vaping at least 1 hour prior to testing

Equipment and Supplies

- Vyntus APS Pneumo
- Dosimeter
- 3 L Syringe
- Microgard Filter
- Disposable mouthpieces (x2)
- Nose Clips
- 3 mL Reconstituted methacholine
- 3 mL Prefilled Saline Syringe
- 18 g Needle
- Alcohol Swab
- Airlife Filter
- Stop Watch/Timer

Procedure

Steps

1. Prior to testing patients on the APS system, a volume calibration and a compressed air check needs to be completed. Remove methacholine from refrigerator at least 30 minutes prior to testing so that it warms to room temperature.
2. Confirm order/requisition and complete the pre-test questionnaire with the patient. Ensure the patient does not have any contraindications to testing.
3. Enter patient demographics into the computer under “patient data”.
4. Ask the patient when they last used any respiratory medications and record this on the final report. If bronchodilators have not been withheld appropriately, inform supervisor.
5. Attach the Microgard filter and hard plastic mouthpiece to the patient side of the hand held spirometer.

6. Complete baseline spirometry in the spirometry program prior to starting the bronchial challenge. Once all criteria are met, click into “Bronchial Challenge”.
7. A box will appear asking if you would like to use the current level as baseline level for the bronchial challenge. **Only select “yes” if the baseline spirometry was completed on the Vyntus APS system.**
8. Place the rubber stopper on the end of the nebulizer.
9. Select “Checks” from the top bar menu and scroll to “Compressed Air Check”, then press “OK” to allow the compressor to turn on and check for leaks.
10. Attach a plastic mouthpiece **without** a filter onto the nebulizer block.
11. Unscrew the nebulizer cup and fill it with 3 mL of normal saline. Put the syringe aside for later use.
12. From the nebulization screen, ensure that the NaCl dose is highlighted before pressing “F1” to start the nebulization process.
13. Instruct the patient to use basic tidal breathing technique with their lips tightly sealed on the mouthpiece and nose clips on. The patient should **not** inhale to TLC during nebulization.
14. Once nebulization has finished, immediately click “F5” to start spirometric measurements.
15. Using a stopwatch or timer, have the patient complete a flow volume loop at 30 seconds and again at 90 seconds. Flow volume loops should only be done a **maximum of 4 times** at each dose.
    NOTE: The patient will only have to exhale for 3 seconds as FEV1 is the only measurement being recorded.
16. Select the test with the **largest** FEV1 and press “save”. Use the “return to bronchial challenge” button to return to nebulization screen.
17. Remove the nebulizer cup and discard the saline from the cup into the stericycle. **Do not discard the baffle.**
18. Use the empty saline syringe and the 18 G needle to draw up 3bmL of methacholine.
19. Deposit methacholine into the nebulizer cup and attach the cup back onto the unit.
20. From the nebulization screen select the starting concentration of methacholine. Initial dose should be selected from “P4” (or any higher concentration as appropriate). To choose the baseline FEV1 to be used throughout the test, double click on the highest FEV1 from baseline **OR** saline spirometry.
21. When the starting concentration has been selected, highlight the dose that will be delivered before pressing “F1”
22. Again, ask the patient to breathe slowly in and out (tidal breathing) through the mouthpiece with their lips tightly sealed on the mouthpiece and nose clips on. The patient should not inhale to TLC during nebulization.
23. Once the nebulization is complete, repeat the spirometric measurements at 30 seconds and again at 90 seconds.
24. Repeat this pattern until the provocative dose (PD_{20}) (FEV1 decrease of at least 20% from **baseline**) is reached, or until all of the methacholine doses have been given.

End of Test Procedure

1. Once PD_{20} is reached, or all of the methacholine testing doses have been given, the test has ended and reversal can be started.
2. Administer 400 mcg of Ventolin (4 puffs) via MDI and spacer while monitoring the patient's respiratory status.
3. Allow 5 minutes to pass before repeating a spirometry to check for reversal.
   NOTE: Do not exit out of the spirometry screen until patient's FEV1 returns to baseline.
4. Dispose of any excess methacholine into the Stericycle; the glass vial and 18G needle are to be disposed of into the sharps container.
5. If after 10 minutes the FEV1 has not improved (within 10% of baseline) administer another 2 puffs of Ventolin or Atrovent via MDI and spacer
6. If there is still no improvement after the second dose, notify the on site Respirologist to determine next steps. Comment on any symptoms of acute bronchospasm or discomfort the patient may have experienced during testing.

Documentation

The Respiratory Therapist should include any relevant information that may affect testing to the "Comment" section of the test report. (i.e. evaluation of patient effort and cooperation, medication history, testing difficulties, etc.)

References

- Coates AL, Wanger J, Cockcroft DW, et al. ERS technical standard on bronchial challenge testing: general considerations and performance of methacholine challenge tests. Eur Respir J 2017; 49: 1601526 [https://doi.org/10.1183/13993003.01526-2016].
- Cockcroft DW, Davis BE, Roh Y, et al. Effect of ingested H1 antihistamines on methacholine challenge. J Allergy Clin Immunol 2015; 135: 579–580
- Cockcroft DW, Methacholine Challenge PD20 versus PC20, ATS Journals 2015; DOI: 10.1513/AnnalsATS.201501-049ED, https://www.atsjournals.org/doi/pdf/10.1513/AnnalsATS.201501-049ED

Initial Effective Date:	15-OCT-2021
Posted Date:	12-JUL-2023
Last Revised:	12-JUL-2023
Last Reviewed:	12-JUL-2023
Approved By:	PHC
	Professional Practice Leader, Respiratory Services Pulmonary Diagnostics Coordinator, Respiratory Services Medical Director, Pulmonary Function Lab
Owners:	PHC
	Respiratory Services