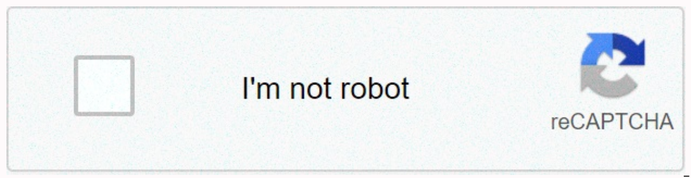


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# Pneumatic otoscopy test time

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The Siegle otoscope design was a simple but brilliant modification of an older diagnostic otoscope. The change consisted of a short, steel straw, capped by a hollow spherical flange. The base of the tube was welded to the barrel of the otoscope head and a hole was drilled through the steel vessel to allow air under pressure into the chamber of the characteristic otoscope head. One end of a rubber tube can be attached to the spherical flange, and the other end of the tube was inserted into the examiner's mouth just past the alveolar ridge. Richard H. Schwartz The purpose of the Siegle modification was to create a simple pipe for the application of pressurized air to evaluate the movement of the eardrum, while negative pressure followed in order by positive pressure was applied by the mouth (or can be applied via rubber ball). An auditory speculum was originally permanently applied to the open end of the barrel of the Siegle otoscope head. Subsequent modification of the original Siegle design included interchangeable auditory specula, a magnifying glass and a battery-containing handle. The most recent major improvements in handheld otoscopes are halogen and halogen HPX (high power xenon) lamp lighting, 3.5-volt nickel cadmium or lithium rechargeable batteries and interposition of a rubber gasket between the sliding roll cap and the head of the otoscope to reduce air leaks. The Welch-Allyn MacroView otoscope head promises 30% more magnification and improved reproduction of the entire eardrum. A disadvantage This excellent look diagnostic head is the poor design of the pneumatic part of the otoscope. It has a receptive hole and requires an adapter to pneumatic tubes. It would have been a better design if the diagnostic head had a male projection similar to the chrome-plated steel 20200 diagnostic head. Most characteristic otoscope heads today are manufactured from a plastic cryolite polymer. Instead of a projecting flanged rod for the attachment of a rubber tube, there is a hole drilled into the barrel of the otoscope head. This modification requires a simple plastic male adapter to fit through the hole in the barrel and serve as an anchor for the tube leading from the rubber pneumatic lamp. The cylindrical casing made of chromed stainless steel is still available from several manufacturers (including the Welch-Allyn 20200), and it is preferred by most experts in pneumatic otoscopy. It is the recommended diagnostic otoscope head at Children's Hospital of Pittsburgh and the University of Pittsburgh School of Medicine. Performing the procedureThe art of pneumatic otoscopy is difficult and often not well mastered, but it is essential for an accurate diagnosis of health or disease in the middle ear split. A summary of five studies comparing the accuracy of pneumatic otoscopy with that of myringotomy for otitis media with effusion had an average sensitivity score of 89% and average specificity score of 80%. In a study on the frequency of use of the pneumatic otoscope, only 21% of respondents used it at all times and 42% never used it. The pneumatic otoscope allows a small volume of generated negative, followed by positive air pressure to assess the mobility of the eardrum in an outward (lateral, to the examiner) and inward direction. When the pressure in the middle ear split is the same as the pressure in the exam room, the normal TM moves about 1 mm laterally and 1 mm medial. Impedance to the medial movement of the TM usually means either there is a fluid (mucus, serum, blood or pus) split in the middle ear, a solid mass such as a tumor or cholesteatoma is occupying the middle ear split or the TM being retracted medial. One of the above may impede the further medial movement of the TM when positive pressure is generated by the pneumatic otoscope. We all recognize that acute otitis media and otitis media with effusion are among the most common upper respiratory diseases in infants, toddlers and preschoolers. In my experience in northern Virginia, the technique of proper pneumatic otoscopy has not been properly demonstrated by teachers of physical diagnosis and is poorly understood by medical students, general practice and pediatric residents. Conditions There are several essential conditions that need to be introduced before the technique of pneumatic otoscopy can be successful. Every research room contain a halogen-lighted otoscope with a loaded nickel cadmi-lumber that has not exceeded the expiration date, normally two years after purchase. As noted in a previous office maintenance otoscope column, halogen lamps that cost about $25 each should be replaced each each months after frequent use. The child's auditory tracts must be cleaned of almost all debris, including cerumen and desquamated skin, to allow visualization of the entire circumference of the TM. A common mistake is to peek through a small hole in the cerumen and diagnose the pathology of the middle ear by visualizing a small part of the TM. The different techniques of cleaning the ear canal were also covered in a previous column. Many pediatricians who have validated experts in pneumatic otoscopy use a stainless steel angled #0 or #1, Buck's design cerumen curette to remove ear canal debris in most children. There is no data that I am aware of that evaluate the effectiveness of twisted nasopharyngeal swabs or commercially available plastic cerumen loops or spoons compared to the standard stainless steel auditory curette. Babies and toddlers' heads can be immobilized in a side position (an ear to the examiner), often against their mother's chest. Pneumatic otoscopy rulesRege #1: Each pneumatic otoscope should be periodically tested for leaks in the intrinsic and extrinsic system. To investigate for air leaks in the intrinsic system, the examiner only needs to attach an auditory speculum to the diagnostic otoscope head and insert the end of the speculum with the tip of an index finger. Positive pressure is applied in the cylindrical body of the otoscope head by means of a attached rubber or plastic tube connected to a rubber ball or into the mouth of the examiner. If there is a sealing leak at the intersection between the open end of the cylindrical body of the otoscope and the auditory speculum or at the intersection between the retractable lens cap and the body of the otoscope, there will be a leak of pressurized air at the site of the faulty seal. There are three locations where air leaks can occur in the extrinsic system, the most common of which is at the intersection between the point of the auditory speculum and the ear canal of the child. The air under pressure then leaks out of the external auditory meatus. The TM appears immobile or poorly mobile, and the examiner mistakenly believes that the child has otitis media with effusion. For this reason, it is essential that a size 3 or 4 auditory speculum be used for most young children to achieve a good seal that may or may not be airtight. Adolescents and young adults often have a commercially available 5 mm or 7 mm, SofSpec rubber tip aural speculum (Welch-Allyn). If the 3 mm or 4 mm speculum continues to have an air leak after applying tragal pressure, the problem can be solved by cutting off a 2 mm band of 3/8 inch diameter latex rubber tubes and cutting this rubber band wrap over the tip of the aural speculum I recommend placing the auditory speculum (without the rubber gasket described above) at almost 1 cm in the ear canal of infants and young children, achieving a good seal and aiming the beam of light on the TM. Because some eargoers are not perfect and there is an imperfect seal between the speculum tip and the ear canal, it is often necessary to improve the air seal by pressing the child's tragus at an index point, which in turn improves the seal between the speculum point and the ear canal wall. Another place of possible air leak in the extrinsic system is at the intersection between the male adapter that connects the rubber tube to the black resin body of the popular, but not recommended by me, diagnostic otoscope. This type of air leak can be difficult to fix and may require a larger size of the adapter, application of a flexible material around the insertion point or the re-editing of the hole in the otoscope head. A third place of possible leak is an accurate perforation of the rubber tube that connects the body of the characteristic otoscope with either a pneumatic sphere or a plastic mouthpiece. With the age and deterioration of the rubber, pinpoint perforations can develop anywhere in the rubber tubes, but especially where one end of the hose connects to the male adapter (or on the feline part of the male adapter on the cylindrical body of the stainless steel diagnostic otoscope head). It should be stressed that the TM itself should not have perforations for successful pneumatic otoscopy. This includes small pinpoint perforations or patent tympanostomy tubes. Rule #2: Right the ear canal to get the most direct route for the otoscope speculum to be inserted at the optimal depth by gently pulling the superior helix of the auricle outward and down in infants and up and back in older children. This is a general rule that requires modification and individualization to allow the right line to insert the otoscope pod. The speculum should be inserted with a gentle rotating motion in infants and in children with Down syndrome, because such children often have stenotic auditory channels, which makes a lot of difficulty with the visualization of the TM. Rule #3: Applying soft negative pressure against the TM to evaluate lateral (outgoing) movement of the TM is essential. Pneumatic otoscopy is not only the application of positive pressure exerted by a pneumatic sphere or by clouds of smoke from the examiner's mouth through the rubber tube in the airtight pneumatic otoscope head. The correct pneumo-otoscopic technique requires the examiner to first create a negative pressure through the rubber tube through the sphere or mouth to transfer that negative pressure against the eardrum. This is a crucial part of pneumatic otoscopy and is rarely taught or used by pediatric trainees, hospitalists or pediatricians in practice. Why do I sub-co-effi the application of negative pressure is a requirement? When positive pressure is applied only a TM that is simply withdrawn and there is a normal air-filled (under reduced air pressure, however) middle ear split, the TM will not move inward and the examiner can wrongly diagnose otitis media with effusion (secretoire (secretoire (secretoire media). If the TM appears dull and red and there is no movement with the application of positive pressure only through the pneumatic otoscope, the examiner can misdiagnose aom and can incorrectly prescribe antibiotics. Rule #4: Application of negative pressure followed by positive pressure should be soft, and each should be repeated several times. A common error is to apply excessive amounts of compression to the pneumatic lamp. The lamp should be carefully indented and not pressed firmly. Cavanaugh studied the amount of positive pressure delivered during pneumatic otoscopy in 53 pediatric patients. The pressure generated ranged from 338 mm to 1,134 mm of water. The average pressure that was introduced was 748 mm of water with the pneumatic lamp and 502 mm of water through the nozzle method. Some find it easier to apply a similar soft amount of negative or positive pressure by the admittedly unhygienic mouthpiece method than by the pneumatic lamp. The result of this application of overpressure is to move a TM inward, even when there is a significant amount of thin serous liquid in the middle ear. When the pneumatic lamp is used, the examiner should gently compress the lamp slightly inwards, then place the auditory speculum in the ear canal and re-seal the system with tragus compression outwards against the ear passageway if necessary. After an airtight seal is attached, the examiner releases the compression on the lamp, causing the TM to move sideways towards the examiner's eye. In order to repeat the application of negative pressure with the pneumatic sphere, it is necessary to remove the auditory speculum and re-apply soft compression of the pneumatic sphere after which that auditory speculum is placed again in the ear canal and sealed airtight. Rule #5: Validate your otoscopic skills regularly, using spectral gradient acoustic reflectometry (Ear Check), tympanometry or both. Online courses on the technique of pneumatic otoscopy are sponsored by the AAP (Pedialink); Children's Hospital of Pittsburgh (Enhancing Proficiency in Otitis Media) ePROM curriculum, on and Diagnostic Ear Assessment Resource (DxEAR) on (by invite only); Dr. Michael Pichichero (Outcome Management Educational Workshops. Workshop schedule on the Internet on www.omew.com), and others. Although the color of the normal TM has a blue tint, the videos of the actual pneumatic otoscopic technique are very well done. If time permits, one morning, visit your otolaryngology colleague (preferably a pediatric ENT) and compare your pneumatic otoscopic diagnosis with that of the specialist. One problem is that primary care physicians will have much more from acute otitis media encounter then the specialist and children with AOM can not be seen on the same day as you in the office or operating room. Rule #6: Swap your black, rectangular diagnostic otoscope with the lateral sliding for the chrome-plated steel cylindrical model. Do not use the ubiquitous disposable 2.5mm black auditory specula to examine the ears of infants and toddlers. They are of a particularly poor design to be inserted deep enough into the ear canal of babies, they often allow air leaks between the tip of the speculum and the ear canal of the child, and the light beam is directed proximally at the surface of the TM rather than on the TM. For example, the light is slightly less concentrated on the TM itself. Stan Block, MD, published an excellent commentary in pediatrics, where he succinctly noted several reasons to get rid of the disposables. If you are serious about improving pneumatic otoscopy skills, this rule should be followed. ConclusionA remains an uphill battle to inform educators and their students and primary care residents about pneumatic otoscopy and the preferred technique to develop expertise in this procedure. The most consistent and reproducible results occur when the instrument is powered by nickel cadmium or lithium batteries, halogen or halogen-xenon lamps, an airtight system, a chrome-plated stainless steel otoscope diagnostic head and the original nylon auditory specula (cleaned with alcohol after each use) - certainly not the 2.5mm disposable specula. It should be an integral part of the otoscopic examination of all young children. For more information: Richard H. Schwartz, MD, is from the Pediatrics Department of Inova Fairfax Hospital for Children, Falls Church, Va.

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