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OTITIS MEDIA

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The WSCC Care Pathways provide a standardized context for clinical decision-making as well as a menu of possible interventions. These pathways are not intended to replace the clinical judgment of the individual physician. The needs of the individual patient may make it necessary to deviate from the recommendations contained in any given pathway.

Limitations

WSCC Care Pathways are intended for use within our clinic system. They may have wider application, but caution must be exercised. The following limitations would have to be addressed. 1) The literature searches employed would need to be more exhaustive; 2) inclusion criteria for published studies would need to be more stringent; 3) a wider pool of subject-matter experts must be tapped; 4) the participants of the CSPE Consensus Panel would need to be drawn from a broader cross-section of the profession and perhaps other health care providers as well. Although individual procedures and decision-making points within the Care Pathways have established validity or reliability, the pathways as a whole are untested.

ICD-9 Codes

381 = Nonsuppurative otitis media and Eustachian tube disorders [use for OME]

381.0 = Acute nonsuppurative otitis media
Includes: acute tubotympanic catarrh, otitis media; acute or subacute: catarrhal, exudative, transudative, with effusion
Excludes: Otitic barotrauma (993.0)

381.00 = Acute nonsuppurative otitis media, unspecified

381.01 = Acute serous otitis media
Includes: Acute or subacute secretory otitis media

381.05 = Acute allergic serous otitis media

381.1 = Chronic serous otitis media
Includes: Chronic tubotympanic catarrh

381.10 = Chronic serous otitis media, simple or unspecified

381.3 = Other and unspecified chronic nonsuppurative otitis media
Includes: Otitis media, chronic: allergic, exudative, secretory, seromucous, transudative, with effusion

381.4 = Nonsuppurative otitis media, not specified as acute or chronic
Includes: Otitis media, chronic: allergic, catarrhal, exudative, mucoid, secretory, seromucous, serous, transudative, with effusion

381.5 = Eustachian salpingitis

381.6 = Obstruction of the Eustachian tube: Stenosis or stricture

381.60 = Obstruction of the Eustachian tube, unspecified

381.9 = Unspecified Eustachian tube disorders

382 = Suppurative and unspecified otitis media [use for AOM]

382.0 = Acute suppurative otitis media, otitis media, acute: Necrotizing NOS, purulent

382.00 = Acute suppurative otitis media without spontaneous rupture of the eardrum

382.01 = Acute suppurative otitis media with spontaneous rupture of the eardrum

382.1 = Tubotympanic suppurative otitis media
Includes: Benign chronic suppurative otitis media, chronic tubotympanic disease; with perforation of the eardrum

382.4 = Unspecified suppurative otitis media: Purulent otitis media NOS

382.9 = Unspecified otitis media: Otitis media: NOS, acute NOS, chronic NOS

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NOTES

BACKGROUND

Otitis media is the clinical term used to describe conditions that are associated with inflammation and effusion in the middle ear. There are two types:

1. **Acute otitis media** (AOM) which has signs of middle ear effusion along with signs and symptoms of an acute infection (Hendley 2002).

2. **Otitis media with effusion** (OME) which also has signs of middle ear effusion but without signs and symptoms of an acute infection. OME can be a sequela of AOM. (Clinical Practice Guideline, Pediatrics OME 2004)

AOM and OME pose separate challenges in terms of evaluation and management. In most cases, both conditions are self limiting, and a conservative watchful-waiting approach to management has been adopted by most healthcare authorities. In more severe cases of AOM, referral for antibiotic therapy and/or surgery may be warranted. Although usually self limiting, OME can develop into a chronic condition that requires diligent monitoring over weeks or even months to ensure that no long-term hearing loss or learning disabilities develop.

Pathophysiology

The sequence of events leading to otitis media is not completely understood. Eustachian tube dysfunction, chronic upper respiratory infections, food sensitivities, and environmental and social risk factors have been implicated as contributing significantly to this disorder (Berkow 1951, Shapiro 1995). Although adults and children of all ages may suffer from otitis media, children under the age of six are most frequently afflicted (Eden$_a$ 1995). Some clinical researchers in this area attribute this to the smaller, shorter and/or less rigid configuration of the pediatric Eustachian tube (Bluestone 1982, Eden$_a$ 1995, Koufman 1990, Shea 1971, Taylor 1993).

Acute Otitis Media (AOM)

AOM is most common in children and is frequently preceded by an upper respiratory infection (Eden$_b$ 1995, Shapiro 1995, Tierney 1993). It may be viral or bacterial in nature. The presence of infection can be definitively diagnosed only when aspirated fluid from the middle ear (tympanocentesis) has been analyzed by clinical lab procedures (Demlo 1994). *Streptococcus pneumoniae*, *Morexella catarrhalis* and *Haemophilus influenzae* are the most common bacterial pathogens associated with this disorder (Pichichero 2005, Clinical Practice Guideline, Pediatrics AOM 2004). Due to the invasive nature of tympanocentesis, this technique is not commonly used for diagnostic purposes.

It has been suggested that the combination of an immature immune system, dysfunctional Eustachian tube, and frequent bouts of upper respiratory infections leads to an inadvertent viral and/or bacterial inoculation of the middle ear and subsequent suppurative infection (Cantekin 1987, Casselbrant 1985, 1987, Eden$_b$ 1995, Koufman 1990, Shapiro 1995, Tierney 1993).

In the beginning stages of otitis media, the insulting pathogen causes local vasodilatation, which to the observing physician appears as a prominent vascular strip that is greater than the normal presentation of the red reflex along the manubrium. Eventually, the entire tympanic membrane may become red and inflamed. (Koufman 1990)

In the next stage, exudation takes place. Bacterial toxins cause the vascular elements of the middle ear to increase in permeability. This permeability causes the middle ear to fill with exudates while the hyperemia continues.

White blood cells migrate into the middle ear from the surrounding capillary beds of the middle ear mucosa. An occluded Eustachian tube traps the accumulating suppurative debris in the middle ear cleft, which causes the tympanic membrane to bulge painfully.

The tympanic membrane may rupture, allowing the middle ear to discharge its contents and relieve the severe otalgia (Koufman 1990).

Likely AOM Sequelae

- **Mucosal edema of adenoidal and neighboring lymphoid tissue**
- **Blockage of Eustachian tube**
- **Opportunistic bacterial infiltration into nasopharynx**
- **Sneezing, coughing and/or sniffing forces bacteria up the Eustachian tube**
- **Proliferation of bacteria or inflammation**
- **Accumulation of serous or purulent exudate leading to middle ear effusion (MEE)**
- **Presentation of clinical signs and symptoms**

Otitis Media with Effusion (OME)

OME has formerly been known by many names: serous otitis media, secretory otitis media, glue ear, fluid ear, tubotympanitis, exudative catarrh, tympanic hydrops, barotrauma, Eustachian tube dysfunction, and chronic otitis media (Bluestone 1982). This type of otitis media is characterized by the accumulation of fluid in the middle ear, which, in turn, causes discomfort and behavioral changes in the patient (Demlo 1994). It may occur along with viral upper respiratory tract infections or may be the sequela of AOM (Casselbrant 1985, Eden$_a$ 1995). OME may also occur spontaneously because of poor Eustachian tube function or as an inflammatory response to AOM (Chonmaitree 2000; Clinical Practice Guideline, Pediatrics OME 2004). The effusion associated with OME can be serous, mucoid or purulent.

Since a countless number of these cases initially appear with many of the same signs and symptoms as AOM, they have been misdiagnosed as bacterial infections and managed with antibiotic therapy (Bluestone 1982, Demlo 1994, Frenkel 1987, Rosenfeld 1992).

Epidemiology

Otitis media is one of the most common childhood illnesses, particularly in children under the age of six years (Casselbrant 1987, Eden$_b$ 1995, Shapiro 1995).

The rate of incidence has been reported to be as high as 62% by the first birthday and 83% by the third. By the age of three, 46% of children have experienced *three or more episodes*. (Eden$_{a/b}$ 1995, Shapiro 1995) Although the vast majority of otitis media cases occur in children under the age of 12 years, the adult population is not immune to this affliction (Tierney 1993).

OME, more common than AOM, makes up a large percentage of these cases. Over 50% of children will experience OME before their first birthday. By their second birthday 60% will have had OME. By the time they reach school age, about 90% of children have had OME, most cases occurring between 6 months and 4 years. (Clinical Practice Guideline, Pediatrics OME 2004)

Natural History

Acute Otitis Media (AOM)

AOM is most often a self-resolving condition. There is, however, a high recurrence rate. When occurrence rates equal or exceed three episodes within a six-month period or four episodes within 12 months, the condition is classified as recurrent (Rosenfeld 2003). In addition, fluid can accumulate in the middle ear and lead to OME and hearing impairment as a sequela (Demlo 1994, Eden$_b$ 1995, Shapiro 1995, Teele 1980).

Although the risk factors involved in middle ear disease are well-understood, (Demlo 1994, Eden$_b$ 1995, Kraemer 1983, Shapiro 1995), it is a difficult task to predict which cases will self-resolve without complication or the need for intervention and which cases culminate in suppurative infection.

No epidemiologic study has addressed the true incidence and prevalence of the complications of otitis media. However, the available literature does document the marked decrease in complications since the advent of antimicrobial usage and puts the complication rate at approximately 6.5%. (Eden$_a$ 1995)

The most common complications, in descending order of frequency, are eardrum perforation, cholesteatoma, mastoiditis, and atelectasis of the eardrum (Farrior 1990). Fluctuating or chronic hearing loss in young children with a history of otitis media has been implicated as a contributing factor to poor development of speech and language skills (Roberts 1989, Roland 1989). The most serious complications identified are meningitis, sigmoid sinus thrombosis, and brain abscess.

An untreated infection can lead to spontaneous rupture of the tympanic membrane (Koufman 1990). After an acute perforation of the tympanic membrane, the middle ear will drain for up to two weeks, after which the repair process begins. Over 90% of otitic perforations heal spontaneously within two months (Koufman 1990).

When ear infections are treated promptly, serious complications such as mastoiditis rarely manifest (Eden$_b$ 1995). However, even when untreated, this complication is very rare. In one study using watchful waiting in place of automatic antibiotic prescription, only one patient developed mastoiditis in a cohort of 5000 patients, and in that case the patient waited nearly a week before intervention (Little 2006, van Buchem 1985).

Chronic or recurrent infections can lead to the need for myringotomy with or without insertion of tympanostomy tubes (Eden$_{a/b}$ 1995, Shapiro 1995).

Otitis Media with Effusion (OME)

OME may be acute (lasting less than three weeks), subacute (three weeks to three months), or chronic (lasting longer than three months). OME is often noted at a well-child checkup or at follow-up examinations after an episode of AOM.

In most cases, this condition is self limiting and spontaneously resolves within a month; 80% of the cases of effusion clear within two months (Casselbrant 1985, Eden$_a$ 1995). As many as 30-40% of children have recurrent problems, however, and 5-10% of episodes last one year or more (Clinical Practice Guideline, Pediatrics OME 2004).

For cases that self resolve, it is suspected that the Eustachian tube normalizes, becomes patent, the fluid drains from the middle ear, the air pressure equalizes, and the patient becomes asymptomatic.

However, in those cases where OME goes undetected or is allowed to persist for months or years, chronic hearing loss develops (Casselbrant 1985). There is a concern that withholding treatment for these chronic cases may have an adverse effect on hearing, speech, language development, learning and behavior (Demlo 1994, Roland 1989).

Risk Factors

All of the following risk factors identified are from infant and childhood population studies. It can be reasonably speculated that at least some of these risks may apply to adult populations as well. The American Academy of Pediatrics (AAP) Subcommitee on the Management of Acute Otitis Media recommends that clinicians encourage the prevention of AOM through the reduction of risk factors. This recommendation is based on evidence from observational studies and a preponderance of benefit over harm. (Clinical

Practice Guideline, Pediatrics AOM 2004) Although the AAP makes no recommendations for or against the role of risk factor reduction to prevent OME, these same simple steps seem reasonable (Clinical Practice Guideline, Pediatrics OME 2004).

- **Infant feeding and pacifier use.** Infants who are breast fed for at least the first six months are far less likely to experience an episode of AOM (6%) than bottle-fed infants (26%) (Saarinen 1983, Clinical Practice Guideline, Pediatrics AOM 2004). The practice of bottle feeding infants has been shown to increase the likelihood of otitis media (Teele 1980). It has been indicated that the use of pacifiers is responsible for 25% of the cases of otitis media in children younger than three years (Niemela 1995). Avoiding unattended supine bottle feeding and pacifier use during the first six months have been shown to reduce the incidence of AOM (Daly 2000, Paradise 1997, Clinical Practice Guideline, Pediatrics AOM 2004). It is unclear whether bottle feeding and pacifiers represent independent risks or are simply associated with a decreased likelihood of breast feeding.

- **Secondary smoke.** Children exposed to an environment where tobacco use is common are three to four times more likely to develop otitis media than those children from a nonsmoking environment (Etzel 1992, Ilicali 1999, Kraemer 1983, Clinical Practice Guideline, Pediatrics AOM 2004).

- **Day care.** Children attending day care are twice as likely to experience middle ear infections as those who are cared for at home. Some early population-based studies place the prevalence as great as three- to four-fold higher. (Bachman 1984) Altering child care center attendance can reduce the incidence of upper respiratory tract infections and AOM significantly (Adderson 1998, Daly 2000, Clinical Practice Guideline, Pediatrics AOM 2004).

- **Socioeconomic status.** Children raised in low socioeconomic conditions are more likely to contract otitis media (Roberts 1989).

- **Season.** There is a higher incidence of otitis media reported during the winter months (Biles 1980).

- **Craniofacial distortions.** There is a higher occurrence of otitis media in children with Fetal Alcohol Syndrome, Down's syndrome, and other conditions causing craniofacial distortions.

- **Dairy.** There is data to support the correlation of childhood consumption of dairy products (specifically cow's milk) and increased likelihood of middle ear infections (Nsouli 1994, Saarinen 1983, Shapiro 1995). At the time of this revision (2007), strong supportive evidence of this proposed correlation is lacking (Clinical Practice Guideline, Pediatrics OME 2004).

- **Allergies.** Children with allergies or family history of allergies are reported to be more likely to contract middle ear inflammatory disorders. A role of food allergies in OME has also been suggested, but the exact incidence is unknown. (Bahna 1988, Hurst 1990, Nsouli 1994) At the time of this revision (2007), strong supportive evidence of this proposed correlation is lacking (Clinical Practice Guideline, Pediatrics OME 2004).

- **Diet.** Children deficient in certain nutrients are at risk for developing otitis media. Those nutrients most frequently implicated are vitamin A, zinc, and essential fatty acids. (Bondestam 1985, Chloe 1979, Hussey 1990, Jung 1988)

EVALUATION

Key Symptoms and Signs: Acute Otitis Media vs. Otitis Media with Effusion

The symptoms of AOM include otalgia (sometimes manifested as ear pulling in infants), fever, otorrhea and irritability in an infant or toddler. These symptoms are sometimes accompanied by anorexia, nausea or vomiting. (Rothman 2003)

A "certain" diagnosis of AOM, based on clinical grounds, must meet all three of the following criteria:

1. rapid onset of signs and symptoms,
2. presence of middle ear effusion, and
3. signs and symptoms of middle ear inflammation. (Clinical Practice Guideline, Pediatrics AOM 2004)

The only *isolated* symptom that is useful in diagnosing AOM is ear pain (specificity 82-92% with +LRs of 3.0-7.3), although it is only present in 50-60% of children (sensitivity has been reported ranging from 54-100%) (Rothman 2003). Ear tugging in an infant is thought to be a sign of otalgia (Harrison 2005).

The presentation of OME is commonly milder than that of AOM and can be present in an asymptomatic patient. Patients may present with ear pain and/or conductive hearing loss ($Eden_a$ 1995). Sometimes there is only a sense of ear fullness or "popping."
Like AOM, OME in infants may present with ear rubbing, excessive irritability, and sleep disturbances. Hearing loss could also be the dominate feature. Indirect evidence of hearing loss includes failure to appropriately turn toward or respond to voices or environmental sounds, lack of attentiveness, behavioral changes, or the need for excessively high sound levels.

Other indirect indicators include recurrent episodes of AOM, problems with school performance, balance problems, unexplained clumsiness, or delayed gross motor development (Casselbrant 1995, 1998, Golz 1998, Orlin 1997). Delayed speech or language development could also result (Clinical Practice Guideline, Pediatrics OME 2004).

The diagnosis of otitis media, as well as the further differentiation of AOM from OME, is dependent on a combination of factors. While both conditions share many characteristics, the critical distinguishing feature between AOM and OME is that only AOM has acute onset of the signs and symptoms (i.e., over a course of 48 hours). (Clinical Practice Guideline, Pediatrics OME 2004)

In terms of the otoscopic exam, both conditions manifest with middle ear effusion (MEE). The effusion is diagnosed one of three ways:

1. limited or absent mobility of the tympanic membrane as diagnosed by pneumatic otoscopy, tympanogram or acoustic reflectometry; in addition there may be opacification, with or without erythema, full or bulging tympanic membrane, and hearing loss
2. tympanocentesis, or
3. the physical presence of fluid in the external ear as a result of tympanic membrane perforation. (Rothman 2003)

Distinct redness of the tympanic membrane should not be the sole criterion for referring out for antibiotics because it has poor predictive value for AOM and is present in approximately 5% of ears with OME (Karma 1989, Clinical Practice Guideline, Pediatrics AOM 2004). *Retraction* of the tympanic membrane is more suggestive of OME than AOM (Harrison 2005).

Table 1. Differentiating AOM from OME

	Acute Otitis Media	Otitis Media with Effusion
Presentation	Patient appears ill May be dehydrated from vomiting, diarrhea and fever Toddler/child may appear listless	Patient appears normal to mildly ill
Symptoms	Ear pain	No pain or a milder form of ear pain
	Otorrhea	Fullness or stuffiness of ear(s)
	Irritability in infant or toddler	Irritability possible
	Fever/chills	No fever or low grade fever
	Other symptoms that may be present include: ▪ Sleep disturbance ▪ Nausea ▪ Vomiting ▪ Diarrhea	
History	Recent upper respiratory tract infection	Recent upper respiratory tract infection, recent AOM
	Rapid onset of symptoms (< 48 hrs)	Slower onset, may be more chronic in nature
	See risk factors (pages 7-8).	See risk factors (pages 7-8).
Exam	Fever	No fever or low grade fever
	Presence of effusion	Presence of effusion
	Color — Adjusted Positive LR (95% CI)[*] ▪ Cloudy 34 (28-42) ▪ Distinctly red[†] 8.4 (6.7-11) ▪ Slightly red 1.4 (1.1-1.8) ▪ Normal 0.2 (0.19-0.21) Position ▪ Bulging 51 (36-73) ▪ Retracted 3.5 (2.9-4.2) ▪ Normal 0.5 (0.49-0.51) Mobility ▪ Distinctly impaired 31 (26-37) ▪ Slightly impaired 4.0 (3.4-4.7) ▪ Normal 0.2 (0.19-0.21)	Normal to retracted tympanic membrane. The membrane can be cloudy with a visible air-fluid level or bubble, making it difficult to distinguish from AOM (Clinical Practice Guideline, Pediatrics OME 2004). Normal or hypomobility of the tympanic membrane;[‡] however, the membrane can have distinctly impaired mobility, making it difficult to distinguish from AOM (Karma 1989, Clinical Practice Guideline, Pediatrics OME 2004).
	Conductive hearing loss	Conductive hearing loss

[*] Results reported by Karma (1989) were calculated by combining data reported from two groups. Results are rounded so that precision is not overstated.
[†] Distinctly red was described qualitatively as "hemorrhagic, strongly red, or moderately red." (Rothman 2003)
[‡] Diagnosed by 1) typanocentesis 2) fluid in the ear due to rupture 3) limited or absent mobility of the tympanic membrane as diagnosed by pneumatic otoscopy, tympanogram, or acoustic reflectometry. (Rothman 2003)

Evaluation Strategies

In order to accurately diagnose an earache or hearing loss disorder, it is important to determine whether the problem is related to the middle ear and/or Eustachian tube, the external ear and/or auditory canal, or pain referred from other sources.

The types of disorders and subsequent management protocols for external ear complaints differ significantly from disorders of the middle ear.

General evaluation procedures of infants and young children with suspected otitis media should include assessment of growth and development. For the general population, assessment for possible infectious diseases and examination of the head and neck are important.

STEP 1: Take appropriate history.

The history should be directed toward the following issues:

1) **symptoms or behaviors** suggestive of otitis media (both AOM and OME) including the time of onset;
2) **risk factors** increasing the pretest likelihood of otitis media as well as reversible risk factors that could impact management and future prevention;
3) **co-factors** that may make any potential hearing loss associated with OME a greater clinical concern; and
4) evaluation for **pain referral** from other sources if otitis media seems unlikely.

Symptoms of Otitis Media

History should target the classic symptoms of otitis media, either by interviewing the patient or parental guardian. (See Table 1. Differentiating AOM from OME.)

In the case of OME, the onset can be associated with a prior episode of AOM and/or a normal hearing test followed by an abnormal test. However, presentations with such a clear indication of the time of onset are rare in an office setting. In these cases, the date of onset may be inferred from other clues, such as a reported change in the child's behavior. Otherwise, the duration is simply charted from the time of the first visit. (Clinical Practice Guideline, Pediatrics OME 2004)

Evaluation Steps

1. **Take appropriate history.**
2. **Observe for facial distortion.**
3. **Check for signs of infection.**
   a) Check vital signs.
   b) Inspect head, neck and ears for symmetry and signs of infection.
   c) Palpate soft tissue structures of neck.
   d) Apply digital pressure over mastoid.
   e) *If infection is suspected*, look for additional evidence of complications (e.g., enlarged lymph nodes, sinus and throat inflammation, painful mastoid).
4. **Evaluate for hearing loss.**
   a) Whisper test/Watch test
5. **Evaluate external ear.**
   a) Inspect external ear.
   b) Tug on pinna (painful?).
   c) Inspect external canal (otoscope).
6. **Evaluate middle ear.**
   a) Otoscopy
   b) Pneumatic otoscopy
   c) Autoinflation with otoscopy
7. **Evaluate neck biomechanics.**
   a) Assess cervical spine.
8. **If there appears to be no presence of otitis media or other ear pathology, check for other possible sources of referred pain to the ear.**
   a) Check TMJ.
   b) Check cranial nerves V, VII, IX & X.
   c) Check lateral and medial pterygoid, masseter and SCM.
   d) Check for tonsillitis, pharyngitis and carcinoma of the hypopharynx, larynx and cleft defects.
9. ***If necessary*, order or refer for appropriate ancillary studies.**
   a) Acoustic tympanometry
   b) Audiometric evaluation
   c) CBC

Risk Factors

The practitioner should inquire regarding the presence of a recent upper respiratory infection, recent/multiple episodes of ear infection, exposure to passive smoke, bottle feeding, use of a pacifier, and exposure in a child-care setting. If OME is suspected, the patient should also be screened for other factors which may place him or her at greater risk from any accompanying hearing loss. (See Table 2 below.)

Co-factors putting OME patients at greater risk for sequelae

Special additional consideration should be afforded cases of suspected OME. Children who are already at risk for speech, language and/or learning disabilities have a higher need for prompt intervention and assessment of development. The strength of this recommendation is based on case series and "the preponderance of benefit over harm." (Clinical Practice Guideline, Pediatrics OME 2004)

Table 2. Co-Factors Placing Children at Greater Risk for Developmental Difficulties

- Permanent hearing loss independent of OME
- Suspected or diagnosed speech and language delay or disorder
- Autism-spectrum disorder or other pervasive developmental disorders
- Syndromes (e.g., Down's) or craniofacial disorders that include cognitive, speech and language delays
- Blindness or uncorrectable visual impairment
- Cleft palate with or without associated syndrome
- Developmental delay (unspecified)

(Clinical Practice Guideline, Pediatrics OME 2004)

Pain from referred sources

Questions may also be directed to explore other potential causes of ear pain, including referral from the neck or the jaw. (See Steps 6 and 8.)

It is also important to note that unilateral otitis media in an adult can be due a noninfectious process (e.g., tumor) (Isselbacher 1994).

STEP 2: Observe for facial distortion.

Rule out the presence of cranofacial distortions, such as clefts of the hard or soft palate that may not be apparent by general observation, which may predispose the patient to otitis media or hearing disorders.

STEP 3: Check for signs of infection.

The physician should make every attempt to isolate the cases that have clear signs and symptoms of acute infection.

- ✓ Take temperature. Rectal temperatures at or above 100.4°F (39°C) and oral temperatures over 102.2°F (39°C) in both adults and children may indicate the presence of infection (bacterial or viral) and warrant further investigation and/or referral for consideration for antibiotics. Elevated temperatures in general have limited value with regard to etiology, severity, prognosis, or outcome (Rothman 2003); however, they can be used to help decide which patients may be candidates for antibiotic therapy (Clinical Practice Guideline, Pediatrics AOM 2004).
- ✓ Inspect the head, neck and ears for signs of infection.
- ✓ Palpate the cervical lymph nodes and the auricular lymph nodes that overlay the mastoid process. Infection of the ear will usually drain through the retropharyngeal and deep cervical lymph nodes. Lymph nodes that are large, fixed or immobile, inflamed, or tender may indicate the need for further investigation. Tenderness is almost always indicative of inflammation. Lymph nodes become warm or tender to the touch, matted and much less discrete in the presence of infection. (Seidel 1987)
- ✓ Digital pressure over the mastoid process will be painful with involvement of the mastoid air cells, which is common in mastoiditis (Tierney 1993).
- ✓ Look for additional evidence of complications in those cases where infection is suspected. (See Complications of AOM, pp. 17-18.)

STEP 4: Evaluate for hearing loss.

Hearing loss can be screened by a variety of methods including the whisper test.

The whisper test is performed standing at an arm's length behind the patient to avoid lip reading. The evaluator takes in a full breath, breathes out and then whispers a random combination of three numbers/letters (e.g., "2P6") while the patient occludes and rubs the external auditory canal of the untested ear with his/her finger. The examiner can start by using something simple such as "99" in a loud voice to confirm that the patient understands the instructions. The patient is considered to have normal hearing if he/she can correctly repeat all three of the random numbers/letters using the tested ear. If the patient do not respond correctly or not at all, the test needs to be performed again using a different set of numbers/letters. The other ear should be tested accordingly using a different set of random numbers/letters. (Spiro 2006)

In cases where the history may suggest an acute change in hearing (by patient report or parent observation), the patient should be monitored for up to three months (Clinical Practice Guideline, Pediatrics OME 2004). The reported length of time of hearing loss and the time required to arrange for an audiometric exam should also be figured into this calculation.

However, if hearing loss clearly does not seem to be improving as the other ear symptoms improve, the practitioner may wish to refer sooner.

Although commonly used to assess conductive hearing loss, Rinne and Weber tuning fork tests have not been shown to be effective tools in diagnosing OME (Demlo 1994). Given the difficulty in communicating with infants and small children, the tuning fork evaluation is an inappropriate diagnostic tool for this population.

If Rinne and Weber *are* performed in adults or older children, then hearing loss that appears to be sensory, as opposed to conductive, should be referred sooner.

Referral for audiometric hearing testing is recommended in children who are at higher risk for developing long-term hearing deficits. This would include children with craniofacial anomalies associated with cleft palate, Down's syndrome, choanal atresia, retarded development, genital anomaly, and ear defects (see Table 2). Children who are having school performance issues or delayed speech or language development that could be attributed to otitis media should be considered for hearing testing. Patients with OME that persists for more than three months should be considered for referral for audiometric hearing testing. (Clinical Practice Guideline, Pediatrics OME 2004)

STEP 5: Evaluate external ear.

Pain elicited by tugging the pinna of the ear may indicate an external ear problem (Rakel 1990).

External ear complaints can be diagnostically subdivided into disorders of the auditory canal and disorders of the external ear. Disorders of the canal include cerumen impaction and the myriad manifestations that include Swimmer's ear, cholesteatoma, polyps, otomycosis, furunculosis and bony exostosis.

The second category, disorders of the external ear, includes hematomas, frostbite, benign tumors (senile keratosis, gouty tophi, rheumatoid nodules, sebaceous cysts, etc.) and malignant tumors (basal cell and squamous cell carcinoma, melanoma). Given the accessibility of these externalized lesions, they are easier to diagnose than those of the middle ear.

STEP 6: Evaluate middle ear.

AOM can be definitively diagnosed only when fluid in the middle ear is analyzed by laboratory procedures following a myringotomy or when fluid from the middle ear following membrane rupture is tested for bacterial growth. Given the invasive nature and cost of myringotomy, it is not routinely

used as a diagnostic test for otitis media. Therefore, the following indirect methods are used in the diagnosis of otitis media of undetermined origin.

Otoscopy and Pneumatic Otoscopy

The ear is first examined with regular otoscopy, assessing the tympanic membrane, followed by pneumatic otoscopy. Pneumatic otosocopy allows the physician to inspect the tympanic membranes while varying the air pressure within the auditory canal.

Pneumatic otoscopy is the current and most useful exam procedure to help make the diagnosis of otitis media and to differentiate AOM from OME (see Table 1) (Rosenfeld 2003). It is strongly recommended based on systematic review of cohort studies (Clinical Practice Guideline, Pediatrics OME 2004).

Please Note:
Pneumatic otoscopy is the procedure of choice in WSCC clinics.

Technique

First the practitioner must make sure that the attachment of the insufflator bulb to the head of the otoscope is air tight.

Performing the otoscopic exam on children and infants may be problematic because of the inherent lack of cooperation in patients of this age group. The clinician should utilize a nontraumatic approach, using a gentle touch, while making sure the child is properly restrained so that the canal can be adequately visualized and the child is not hurt by the procedure. Children are often more comfortable when restrained by a parental guardian. If the parent is unable to restrain the child adequately, another practitioner will need to assist. One approach is to have the child's body face the parent with his/her head turned to the side in a manner that allows access to the ear. The parent uses one hand to stabilize the patient's temporal area and one hand and arm to stabilize the upper body. The practitioner can also help by gently bracing the head with the hand that is retracting the pinna as well as the hand that is holding the otoscope. This stabilization allows the practitioner to be responsive to sudden movements by the child.

The largest, most comfortable speculum is inserted only as far as the outer one-third (cartilaginous portion) of the ear canal (Clinical Practice Guideline, Pediatrics OME 2004).

There must be a good seal around the auditory meatus. This requires the use of a bulbous rubber-tipped speculum. If using rubber "donuts" on a regular disposable speculum, be certain that the donut fits tightly and will not come off in the patient's ear. Once a proper seal is obtained, air is introduced into the canal by compressing an insufflation bulb attached to the otoscope or by blowing into a tube connected to the scope. Membrane mobility can be better assessed if the pneumatic bulb is slightly compressed *before* insertion due to the negative middle air pressure associated with OME. (Clinical Practice Guideline, Pediatrics OME 2004) A study by Cavanaugh demonstrated that pneumatic bulb attachments can create pressures of 1000 mm of H_2O or more. Only 10-15 mm H_2O was needed to assess tympanic mobility. *Therefore, forceful pressures that create pain are not necessarily an indication of infection*. (Cavanaugh 1989, Rothman 2003)

A Note on the Light Source

Poor light output from the otoscope can lead to diagnostic failure. The otoscope must cast a bright light in order for an examiner to perform a proper otoscopic exam. Weak batteries or poorly functioning bulbs can cause an otoscope to malfunction. In a review article, Pichichero reports on a practice-based study of private practice physicians. Investigators found that one-third of the doctors' otoscopes had suboptimal illumination. Note: Bulbs and batteries should be replaced at least every two years. (Pichichero 2000)

The examiner should observe the relative movement of the tympanic membrane as the change in air pressure occurs. The cone of light can be a good reference point to watch for changes in the tympanic membrane.

Autoinflation of the middle ear may be used occasionally for two purposes. Rarely, it may be used as a method to test tympanic mobility when the practitioner cannot get an appropriate seal with pneumatic otoscopy. It may also be used to affect a change in the patient's sense of ear stuffiness. If the patient is able to easily clear his/her ears by performing a Valsalva maneuver with the nose and glottis closed, the Eustachian tubes are suspected to be patent. There is no evidence as to the accuracy of this procedure. Another method to evaluate tympanic membrane mobility is to have the patient hum while observing for vibration of the membrane. Normally the membrane will vibrate. If no vibration is observed, it can be presumed that there is fluid buildup behind the membrane.

Mobility of the tympanic membrane can be assessed on a range from very hypomobile to good mobility. The more impaired the movement is, especially in the light of other symptoms (see Table 1. Differentiating AOM from OME), the more likely the presentation is due to AOM. Normal movement or only slight impairment, especially in the absence of these symptoms, is more likely associated with either OME or a normal ear.

Mobility of the tympanic membrane in infants younger than seven months is decreased and pneumatic otoscopy may not be reliable (Casselbrant 1987, Eden$_a$ 1995, Taylor 1993). A number of other factors may also make pneumatic otoscopy unsuccessful: inability to sufficiently clear the external auditory canal of cerumen, the presence of a narrow ear canal, the inability to maintain an adequate seal, or examining an uncooperative child. (Clinical Practice Guideline, Pediatrics AOM 2004) In such situations, acoustic tympanometry has been shown to be an effective evaluation procedure in toddlers who are hard to evaluate. (See Tympanometry section on p. 16.)

Validity

Studies have shown that otoscopy alone is not a recommended diagnostic tool for primary diagnosis or distinguishing AOM from OME. Pneumatic otoscopy has been widely credited as an advance over otoscopy alone and is recommended for diagnostic evaluation in suspected otitis media presentations. Pneumatic otoscopy can perform as well or better than tympanometry or acoustic reflectometry. (Clinical Practice Guideline, Pediatrics OME 2004, Takata 2003).

A meta-analysis using myringotomy as the gold standard revealed a pooled sensitivity of 94% (95% confidence interval: 91-96%) and specificity of 80% (95% confidence interval: 75-86%) for trained observers. Pneumatic otoscopy, therefore, should remain the primary method of otitis media diagnosis because the instrument is readily available in practice settings, is cost-effective, and is accurate in experienced hands.

Conclusive evidence is still needed to determine how much training is needed among general practitioners for effective inter-examiner reliability (Takata 2003).

STEP 7: Evaluate neck biomechanics.

Assess the cervical spine for normal range of motion, presence of cervical joint dysfunction or myofascial trigger points (see pp. 24-25 for a discussion of the role of manipulation in patients with otitis media).

STEP 8: If there appears to be no presence of otitis media or other ear pathology, check for possible sources of referred pain to the ear.

Referred otalgia commonly occurs with tonsillitis, pharyngitis and carcinoma of the hypopharynx and larynx (Koufman 1990). Secondary otalgia can arise from cranial nerve V, VII, IX and X involvement as well as

disorders of the temporal bone, mastoid, larynx, teeth and tongue (Koufman 1990, Tierney 1993).

Particular attention should be given to the temporomandibular joint. Dysfunction of this joint has been implicated in cases of ear pain and dysfunction (Koufman 1990, Tierney 1993). Myofascial trigger points in the lateral and medial pterygoid, masseter, and sternocleidomastoid may refer pain to the ear (Travell 1983).

STEP 9: ***If necessary,*** **order or refer for appropriate ancillary studies.**

There are a number of diagnostic procedures involving the use of more sophisticated technology that provide valuable information for the physician. The following are the most common.

Tympanometry

Tympanometry is a procedure used to detect disorders of the middle ear. The mobility of the tympanic membrane is indirectly measured by observing its response to varied air pressures placed on the membrane. This test gives a quantitative measure of the tympanic membrane's mobility whereas pneumatic otoscopy is a qualitative observation. Based on limited scientific evidence and expert opinion, tympanometry is an option for use as a confirmatory test for OME. (Babonis 1991, Dempster 1991, Toner 1990)

Making a diagnosis of OME is difficult in many cases. When the diagnosis is uncertain, tympanometry or acoustic reflectometry should be considered as an adjunct procedure to pneumatic otoscopy. (Palmu 1989, van Balen 1999)

Tympanometry using a standard 226-Hz probe tone is reliable for infants age four months or older. Good inter-observer agreement has been reported in routine clinical practice. (Clinical Practice Guideline, Pediatrics OME 2004) Younger infants require specialized equipment with a higher probe tone frequency (Clinical Practice Guideline, Pediatrics OME 2004). The negative predictive value of a normal tympanogram was estimated to be between 64% and 93% (Ben-David 1981, Fiellau-Nikolajsen$_{a/b}$ 1990, Orchik 1980).

The clinician should take into account the compliance of the patient and the likelihood that a tympanometric evaluation will add to the accuracy of the diagnosis. Clinicians should also factor in the expense of this procedure in order to determine cost effectiveness.

Acoustic Reflectometry

Acoustic reflectometry is an instrument that quantitatively measures sound reflected off the tympanic membrane to detect the presence of middle ear effusion (MEE). Unlike pneumatic otoscopy and tympanometry, it does not require a seal of the external auditory meatus.

It can be used when observation with pneumatic otoscopy is not achievable such as when examining the ears of an uncooperative child. It is recommended as an option/adjunct procedure for diagnosing MEE beyond pneumatic otoscopy by the AAP Subcommittee on Otitis Media with Effusion. (Clinical Practice Guideline, Pediatrics OME 2004)

According to one study, acoustic reflectometry has 88% sensitivity and 83% specificity in detecting MEE when an instrument using cut-off five linear units was used (Schwartz 1987). A meta-analysis performed by a literature search from 1966-January 2000 by Takata demonstrated that acoustic reflectometry has a sensitivity of 93.8% (95% CI: 91.1-96.4%) compared to myringotomy (Takata 2003).

An even higher sensitivity (98.7%) and specificity (94.5%) were obtained when instrument optimization was achieved and tympanometry was used as the reference standard instead of myringotomy (Combs 1991).

At the time of this revision (2007), home units were being made available to the public in some areas for parental guardians to determine whether they should take their child to a healthcare provider for intervention.

Tympanocentesis

Tympanocentesis is a term used to describe a surgical puncture of the tympanic membrane with the purpose of draining fluid from the middle ear. Myringotomy is a term used to describe a procedure in which tubes are placed following a surgical incision of the tympanic membrane to drain fluid and relieve pressure. Both *tympanocentesis* and *myringotomy* can be used for diagnostic purposes by culturing the fluid removed from the middle ear for bacterial growth. These terms are used interchangeably in the literature.

Tympanocentesis allows for the collection and testing of fluid from the middle ear and is, therefore, considered the "gold standard" for diagnosing and treating bacterially-related AOM. However, due to the invasive nature of the procedure, tympanocentesis is not commonly performed in a primary care setting where most cases of otitis media present. It should only be performed by someone well-trained in the procedure. Due to this limitation, diagnosing and treating AOM usually relies on the practitioner's knowledge, comfort level, and skills based on the patient's presentation.

Audiometric Evaluation

Audiometric evaluation, commonly used to assess hearing loss, is useful in certain clinical presentations. The Agency for Health Care Policy and Research (AHCPR) guidelines recommend a hearing evaluation in a child who has had bilateral OME for a total of three months. For clinical presentations of less than three months duration, audiometric hearing evaluation is an option (Demlo 1994). Hearing testing should also be considered for anyone with craniofacial defects or developmental delays who are showing signs of hearing loss. Children with a history of otitis media who are showing signs of poor school performance or delayed language development should be tested for hearing loss.

Clinical Lab

If a systemic infection is suspected, a complete blood count (CBC) may be useful in determining proper management or referral. The test is not ordered to differentiate AOM from OME because localized infections usually fail to affect a CBC.

Complications of Acute Otitis Media

There have been no epidemiologic studies to determine the true incidence or prevalence of the complications of otitis media using all patients with otitis media as the denominator. However, the percentage of complications is quite low. ($Eden_a$ 1995) Evidence of complications warrants urgent referral.

The following conditions, although uncommon and infrequent, constitute a serious compromise of a patient's health and require referral to an appropriate allopathic physician.

- **Mastoiditis.** Acute suppurative mastoiditis may evolve via direct extension of the infection following several weeks of inadequately treated otitis media. It is characterized by postauricular pain and erythema accompanied by a spiking fever. X-rays are not routinely ordered in cases of otitis media; however, incidental radiographic examination would reveal destruction of the mastoid air cells. (Farrior 1990)

- **Petrous apicitis.** The medial portion of the petrous bone between the middle ear and the clivus may become a site of persistent infection when the drainage of its pneumatic cells becomes blocked. This may cause foul discharge, deep ear and retro-orbital pain, and 6^{th} nerve palsy (Gradenigo syndrome). (Tierney 1993)

- **Otogenic skull base osteomyelitis.** Infections of the middle ear may result in osteomyelitis of the skull base (Beneke 1989).

- **Facial paralysis.** Facial palsy may be associated with either acute or chronic otitis media. In the acute presentation, it results from inflammation of the 7th cranial nerve in the middle ear. Differential diagnosis of Bell's palsy should be considered. (Moore 1990)

- **Sigmoid sinus thrombosis.** Trapped infection within the mastoid air cells adjacent to the sigmoid sinus may cause septic thrombophlebitis. This is heralded by signs of systemic sepsis (spiking fever and chills) and is sometimes accompanied by increased intracranial pressure (headache, lethargy, nausea, vomiting and papilledema). If not recognized early, it may lead to widespread septic embolization and death. (Kelly 1991)

- **Central nervous system infection.** Otogenic meningitis is the most common intracranial complication of ear infection. In AOM, it arises from hematogenous spread of bacteria. In chronic otitis media, it results either from passage of bacteria along preferred pathways, such as the petrosquamous suture, or from direct extension of the disease through the dural plates of the petrous pyramid.

  Epidural abscesses arise from direct extension of the disease from chronic infection. These abscesses are usually asymptomatic but may present with deep local pain, headache and low grade fever. Intraparenchymal brain abscess may arise in the temporal lobe or cerebellum. (Freidman 1990)

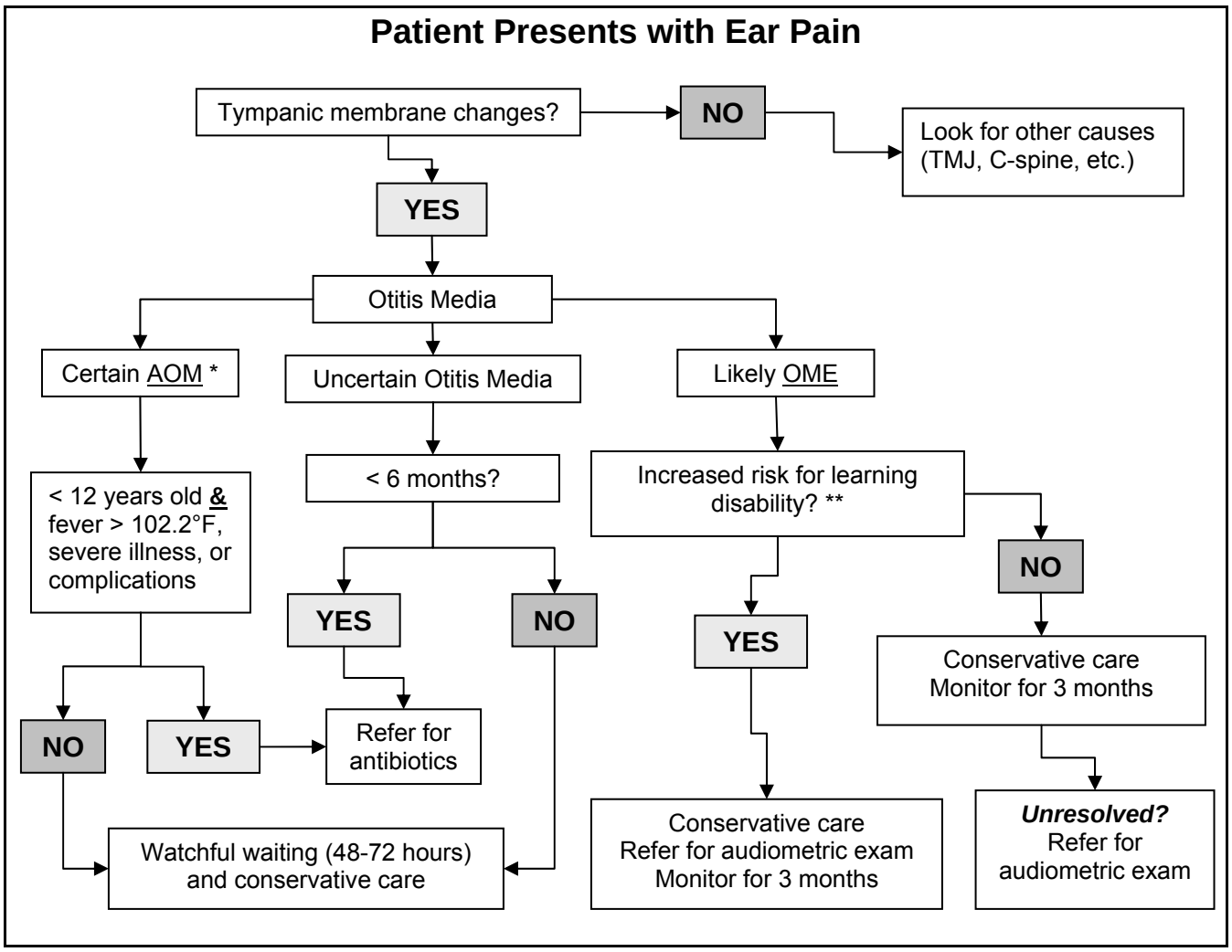
Special Considerations

Special care and attention should be provided to those patients who are additionally health compromised. For example, this is especially true for the diabetic patient with malignant otitis media (osteomyelitic) or otomycotic infections. These are serious conditions that require immediate medical intervention.

It has been suggested that the amount and stiffness of cartilage supporting the Eustachian tube in infants and small children is not conducive to proper drainage (Bluestone 1982). Prior to referring for more invasive procedures, consider that the infant or small child will likely outgrow this disorder.

MANAGEMENT

After determining that a patient has middle ear effusion, a decision has to be made about how to manage the case. This decision is made based on a number of factors. The clinician must first determine whether the patient has OME or AOM (see Evaluation section, pp. 9-18). Both conditions have specific problems associated with them andhave to be addressed differently in order to properly manage them. AOM can progress rapidly into a problematic infection, whereas OME can become chronic and cause long-term hearing problems for the patient. The following algorithm can be used as a tool to help with the management of otitis media but should never take the place of a treating doctor's clinical judgment when managing possible infectious conditions.



* Criteria for Certain AOM (must have all three):

1. rapid onset of signs and symptoms,
2. presence of middle ear effusion, and
3. signs and symptoms of middle ear inflammation.

** Permanent hearing loss independent of OME; suspected or diagnosed speech and language delay or disorder; autism-spectrum disorder or other pervasive developmental disorders; syndromes (e.g., Down's) or craniofacial disorders that include cognitive, speech and language delays; blindness or uncorrectable visual impairment; cleft palate with or without associated syndrome; developmental delay (unspecified).

The American Academy of Family Physicians, the American Academy of Otolaryngology-Head and Neck Surgery, and the American Academy of Pediatrics Subcommittee on Management of AOM and OME recommend a watchful-waiting period of 48-72 hours based on diagnostic certainty, patient's age, illness severity, and follow-up assurance. Watchful waiting should be limited to patients presenting with non-severe illness. This allows the opportunity for the patient to heal without use of antibiotics. It is important during this time that the patient or parental guardian has a ready means of communicating with the clinician of record. (Clinical Practice Guideline, Pediatrics AOM/OME 2004, current through January 8, 2007)

The literature clearly suggests that many of cases of otitis media will spontaneously resolve without the need for more invasive procedures such as antibiotic therapy, tympanostomy, myringotomy or surgery (Browning 1990, Cantekin 1991, Demlo 1994, Frenkel 1987, van Buchem 1981).

However, given the level of discomfort of this common disorder and the high rate of recurrence (van Buchem 1981), the employment of conservative interventions is recommended in order to relieve pain, facilitate the healing process, and decrease the likelihood of future episodes.

Management Strategy

Symptomatic treatment should be considered as an option in the initial management of otitis media based on current evidence. In the case of AOM, it should be noted that antibiotic therapy only shortens symptoms by one day in 5-14% of patients and common antibacterial side effects are seen in as many as 5-10% of those treated with antibiotics. The adverse effects of antibacterial resistance should be considered as well as infrequent serious side effects that accompany this treatment option. In the case of OME, antibiotics are not appropriate at all.

The practitioner and the patient (or parental guardian) should make a management decision based on the type of otitis media diagnosed, the severity of the presentation, and the degree of diagnostic certainty (Clinical Practice Guideline, Pediatrics AOM 2004). Other factors include the age of the patient, parental wishes, as well as other practical considerations discussed below.

Immediate Referral

Although the natural course of both AOM and OME is favorable, some patients should be considered for urgent referral to a primary care allopathic or naturopathic provider.

Patients who are likely to fall into this category include the following:

- Infants less than six months
- Infants/children six months to two years with a *certain* diagnosis of AOM (Clinical Practice Guideline, Pediatrics AOM 2004)
- Patients with fever above 102.2°F (39˚C) (oral temperature) or 100.4°F (38˚C) (rectal) Note: axillary temperatures are not considered as accurate; by convention 1°F (0.6˚C) is added to them.
- Patients with severe ear pain or illness. Infants or children who may be dehydrated or presenting with severe symptoms:
    - very ill, very agitated or listless appearance
    - neurological signs or symptoms
    - severe hearing loss
    - exquisite tenderness over the mastoid process elicited on exam

AOM with milder symptoms

Two courses of action are reasonable for patients with mild or uncertain symptoms of AOM. First, the patient can be referred for a medical consultation in addition to receiving supportive chiropractic care. One advantage of this option is that a prescription may be made available (to be filled if needed) without

any additional delay if the condition worsens. The disadvantage is the cost of an additional office visit and the possibility of taking antibiotics when watchful waiting may be more appropriate.

The second course of action is to proceed with conservative chiropractic care and watchful waiting for a 48- to 72-hour period. If this option is exercised, it is critical that the PARQ conference very clearly delineates the risks and alternatives for standard medical care (see Antibiotics Therapy section on p. 31). The patient should be made aware of the signs and symptoms indicating the need for antibiotic consideration (see the immediate referral list on p. 30). It is important that the patient, or parental guardian, has a plan to rapidly access this consultation if needed. Patients whose symptoms have not progressed but who do not adequately respond within 48-72 hours should also be referred for possible antibiotic therapy. According to the AAP Subcommittee on Otitis Media with Effusion, this recommendation "is based on observational studies and a preponderance of benefit over risk." (Clinical Practice Guideline, Pediatrics AOM 2004) The practitioner should schedule an appropriate follow up within that time frame by phone or in person.

After the acute, active phase of the infection has been controlled, further conservative care and counseling may minimize the likelihood of recurrence or chronicity. (See Management and Prevention of Chronic and Acute Recurrent Otitis Media, p. 33.)

If the patient has any indications of a sinus infection (see CSPE care pathway, Sinusitis and Sinus Pain) or upper respiratory tract infection, then he/she should be treated accordingly.

OME

Children with OME who are not at risk for hearing or developmental problems should be managed conservatively. Management includes watchful waiting for three months from the date of effusion onset (if known) or diagnosis. 75-90% of patients experiencing residual OME following AOM spontaneously resolve within three months. (Clinical Practice Guideline, Pediatrics OME 2004) If a child is not at risk for speech, language or learning disabilities, then watchful waiting poses little risk (Clinical Practice Guideline, Pediatrics OME 2004). (See Table 2.) "This recommendation is based on systematic review of cohort studies and the preponderance of benefit over harm." (Clinical Practice Guideline, Pediatrics OME 2004) (Refer to the immediate referral list on p. 30.)

If the patient has chronic OME for greater than three months and is not responding to conservative therapy, consider referral or consultation (Nelson 1996). In many cases, an extended period of watchful waiting is justified. Children who are not at risk for developing further problems, yet still continue to have the signs and symptoms of chronic OME, should be monitored for hearing deficits and ear drum abnormalities every three to six months. According to the AAP Subcommittee on Otitis Media with Effusion "this recommendation is based on randomized, controlled trials and observational studies with a preponderance of benefit over harm." (Clinical Practice Guideline, Pediatrics OME 2004)

Preventative Care

Following care for the acute phase of otitis media, whether or not antibiotics are used, the patient should be counseled on preventative protocols to minimize the likelihood of recurrent infections.

Specific Conservative Management for OME / Mild AOM

When signs and symptoms warrant conservative intervention, a number of methods can be used.

Specific Therapeutic Objectives

Treatment is centered around the following main goals:

1. Address the patient's symptoms.
2. Affect the Eustachian tube and improve drainage from the middle ear.
3. Identify and, if possible, eliminate the impact of risk factors for future recurrence.
4. In the case of OME with hearing impairment, optimize listening–learning environment.

Summary of In-Office Procedures *(see Office Care below)*

Main procedures

- Administer the endonasal technique, if tolerated.
- Instruct the patient on how to autoinflate the affected ear(s).

Optional/Adjunct Procedures

- Examine and treat the spine for joint dysfunction. Pay particular attention to the upper cervical area (C0-C3).
- Perform auricular adjustment.
- Perform soft tissue massage and instruct the patient on how to massage the soft tissue structures of the neck to promote lymphatic drainage.

Summary of At-Home Care *(see General Home-Care Advice on p. 29)*

- For those patients experiencing significant or intractable pain, administer heat, warmed oil, or ear drops. Do not administer anything in the ear if there is rupture or perforation of the tympanic membrane.
- Perform frequent autoinflation.
- Take analgesic/NSAIDs, if needed.

In many cases, alleviation of the child's ear pain and alleviation of the parental guardian's anxiety are the necessary conditions for success in waiting for resolution of AOM. Every effort should be made to reduce ear pain when present. According to the AAP Subcommittee on Acute Otitis Media, "this is a strong recommendation based on randomized, clinical trials with limitations and a preponderance of benefit over risk." (Clinical Practice Guideline, Pediatrics AOM 2004)

For patients with severe pain, consider the use of OTC analgesics and/or anti-inflammatories. (See CSPE protocol, NSAIDs—Use of Over-the-Counter Nonsteroidal Anti-Inflammatory Drugs and Analgesics.)

It is important to monitor patients on a daily basis during the acute phase of otitis media and while they are using conservative interventions. All of the above conservative interventions can be administered daily or every other day during the acute phase, which usually lasts three to five days. Soft tissue massage, autoinflation, and home care therapies (e.g., warmed oil, local heat, analgesics) can be administered on an as needed basis.

NOTE: In cases of AOM, if the signs and symptoms do not resolve, diminish or stabilize in 48-72 hours, or if the symptoms progress, the patient should be referred for consideration of antibiotic therapy (see p. 31).

Office Care

Manual Therapy: Adjustments and Mobilization

The role of manual therapy for patients with ear pain or otitis media has not been subjected to well-designed outcome studies. Although two studies have suggested benefit for cervical manual therapy, they were of either poor quality or too limited to draw firm conclusions. In the case of endonasal technique, auricular adjustment and lymphatic drainage, no published research at all was found.

The following recommendations are made in the light of available published research, biological plausibility, the level of risk attached to the procedures, and the clinical experience of the CSPE Consensus Panel.

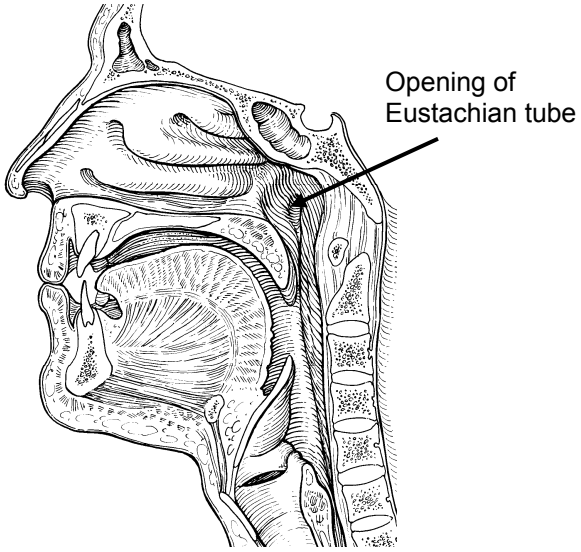
To see a utilization profile of what therapies are used most often in WSCC clinics, see Appendix IV.

Endonasal Technique (Finnell$_{a/b}$ 1951, Gillett 1928, Lake 1942)

The consensus of the panel is that endonasal technique is usually applied in cases of OME in which the tympanic membrane is retracted and demonstrates decreased mobility with pneumatic otoscopy.

It may also be appropriate in less clearly delineated cases. These cases include a tympanic membrane that appears to be moving well but is retracted, as well as cases in which the tympanic membrane is only slightly bulging and hypomobile, suggesting that AOM is either unlikely or, if present, appears to be mild.

Some, but not all panel members, suggest that the procedure may even be useful in cases in which the tympanic membrane appears normal, but the patient complains of ear pain and/or stuffiness.



Procedure

A glove is worn for this procedure. If a latex glove is used, it is important to first ask if the patient has a latex allergy. The practitioner can then instruct the patient to open his/her mouth and say “Ah.” The gloved finger is inserted, palmar surface upward, into the mouth. Proceed past the uvula (minimize direct contact) into the nasopharynx and laterally outward and upward to the fossa of Rosenmueller.

A superior to inferior sweep of the fossa is made and a tractional tug of the inferior tissues is applied as the finger is withdrawn. Antiseptics such as dilute solutions of phenolated iodine, Chloraseptic®, or chlorophyll astringent can be applied to the gloved finger to minimize bacterial inoculation into the fossa.

Gargling with a mild antiseptic mouthwash or warm saltwater after the procedure may decrease the risk of spreading infection as well.

The panel suggests that endonasal technique can be performed daily or every other day as a therapeutic trial for the treatment of otitis media. If reduction of symptoms is not achieved after 1-2 treatments, it is unlikely that further treatments will result in a positive response.

Note: Unless patients are already on antibiotics, endonasal technique should <u>not</u> be done when there is evidence of an acute throat infection with exudates that may be transmitted from the nasopharynx to the middle ear.

Rationale: *This procedure is thought to open and stimulate the Eustachian tube, sometimes resulting in drainage of accumulated fluids from the middle ear.*

Side effects: *There are no known complications to the endonasal procedure. However, some patients may have trouble tolerating the procedure if they have a strong gag reflex. Patients may also report an unpleasant taste and the sensation of drainage into the throat. Also, some patients may experience minor swelling and/or slight bleeding from capillary rupture in the nasopharynx.*

Cervical Adjustment/Joint Mobilization

The exact role of cervical manipulation in the management of otitis media remains controversial. Chiropractic spinal manipulation has little research to support or refute its efficacy in the treatment of otitis media. For example, the American Academy of Pediatrics does not recommend for or against the use of any CAM intervention "based on lack of scientific evidence documenting efficacy." (Clinical Practice Guideline, Pediatrics OME 2004)

The CSPE Consensus Panel was split about the role of cervical manipulation. A number of members with significant experience treating infants, children and adults with otitis media reported that some patients demonstrated immediate beneficial responses that would fall outside of what would be expected in natural history (e.g., popping of the ear, clearing of stuffiness, a calming effect on a child in discomfort, etc.). (See rationale below.) Recognizing that these reports are anecdotal and that the value of this intervention is questioned by other members of the panel, cervical adjusting is included here as an optional or adjunct therapy.

Effectiveness: *No randomized controlled trials of chiropractic in the treatment of otitis media have been published in peer-reviewed journals. One pilot study structured as a case series* (Fallon 1997) *demonstrated benefit but had no controls and results were consistent with natural history. A small RCT of nonadjustive, osteopathic manual therapy demonstrated the reduced need for surgery in children with recurrent otitis media.* (See Appendix II for details).

Rationale: *The application of cervical adjusting falls into four rationales.*

1) *It may have a functional effect on the Eustachian tube. Potential mechanisms are lightly speculative. The anatomical relationship between the muscles of the soft palate, the tensor veli palatini, levator veli palatini, the salpingopharygeus and the Eustachian tube has a structural influence on Eustachian tube patency. Following the concept that form affects function, Mills (2003) suggests that this structural influence on the tube's patency may be affected by manipulative therapy allowing proper functioning of the tube. Another author proposes that the effect of manual therapy may be neurologically mediated by the relationship between the upper cervical segments and the muscles affecting the opening of the Eustachian tube, such as the tensor veli palatini and levator veli palatini via the superior sympathetic ganglion, pharyngeal plexus and vagus nerve.* (Snyder 2002)
2) *Some of the ear pain, especially in uncertain diagnoses of otitis media, may be somatic referred pain from the cervical joints, which may respond favorably to manipulation.*

3) *Otitis media may have secondary effects adversely affecting the cervical spine and musculature. These effects include potential reflex joint dysfunction or antalgic behaviors that may result in abnormal postural loads on the cervical joints and soft tissue.*
4) *Correction of any concomitant joint dysfunction of the cervical spine or the spine in general may have secondary effects in terms of improving spinal mechanics (unrelated to the otitis media) or may have nonspecific effects postulated to include increasing the immune response and decreasing the stress on the body as a whole.*

Side effects: *Mild to moderate, temporary, self-limiting side effects to manipulation of the cervical spine have been reported at frequency of 30% in adults* (Hurwitz 2005). *The most common reported adverse reactions include local discomfort, headache, tiredness and radiating discomfort. Less information is available regarding children. In one case series of 332 children treated for AOM or OME, no side effects were reported.* (Fallon 1997)

Auricular Adjustment/Mobilization

Auricular adjustment or mobilization is a procedure that may decrease pain or sense of stuffiness. Patients sometimes report a sense of drainage into their throat. It is sometimes used either in place of or in conjunction with endonasal technique (see pp. 23-24).

Procedure

The patient's ear is gently pulled, tractioning it into in a full complement of directions. If there is no immediate therapeutic benefit, one option is to more forcefully tug the ear. One way this is achieved is by placing the physician's index finger behind the ear and the corresponding thumb along the antitragus and antihelix. The direction of the forceful tug is generally away from the head and into the direction of tension. Frequently, an audible release is heard.

Rationale: *Justification for auricular adjustment/mobilization is based primarily on the experience of some members of the CSPE Consensus Panel. There is no external data available to support this intervention.*

Side effects: *This can sometimes be an uncomfortable procedure. There are no known or reported adverse side effects other than temporary redness and warmth.*

Soft Tissue Manipulation

Justification for soft tissue manipulation is based primarily on agreement of the CSPE Consensus Panel.

This procedure can be conducted by either the physician or by the patient following self-help instruction.

Superficial effleurage. A gentle massage of the anterior and posterior soft structures of the neck is intended to promote lymphatic flow away from the involved lymphoid tissues. A superficial, slow and mild stroking massage in a superior to inferior direction can be administered by the physician or can be demonstrated to the patient for home-care. Application is usually less than a minute.

Rationale: *Soft tissue manipulation and/or massage is believed to increase blood flow locally, facilitate lymphatic flow, and encourage drainage of fluid accumulation from the middle ear.*

Side effects: *There are no known or reported adverse side effects associated with this procedure.*

Tympanic Ventilation

Tympanic ventilation is a conservative intervention used in the management of otitis media which involves the forceful administration of air through the Eustachian tube into the middle ear space (Bluestone 1982, Chan 1987, Schwartz 1978, Shea 1971, Williams 1968). Resolution of negative intra-tympanic pressure through tympanic

ventilation has been shown to be up to 91% effective in cases of OME (Schwartz 1978). Normalization of middle ear pressure can be achieved by autoinflation, a modified Valsalva maneuver, or by politzerization (use of an inflation bulb).

Autoinflation (AKA, tympanic ventilation) is done by having the patient occlude the nostrils by pinching the nose. The patient closes the glottis and blows gently as if trying to blow up a balloon. The patient continuously blows until a "popping" in the ear(s) is heard or a noticeable change in the middle ear pressure is felt. (Chan 1987, Shea 1971)

For **politzerization**, an external instrument is required that introduces positive air pressure through the nose during deglutition. This is most commonly performed with a small, one-ounce rubber bulb. The bulb tip is placed into one nostril while the other is manually occluded. Air is squeezed from the bulb in synchrony with the act of swallowing. (Arick 2005, Schwartz 1978)

These procedures are usually done following the endonasal technique. Autoinflation can be performed at regular intervals throughout the day.

Tympanic ventilation will cause the patient to experience a feeling of fullness or pressure in the middle ear. Existing data suggests that following tympanic ventilation, the middle ear pressure will normalize in approximately one-half hour. (Schwartz 1978)

Once the pressure in the middle ear has normalized, ventilation can be performed again. This time frame might provide some guidance for establishing appropriate ventilation intervals. This technique can be employed until the ear appears to have permanently cleared.

Rationale: *It is thought that tympanic ventilation equalizes pressure in the middle ear chamber, allowing fluid accumulation to drain through the Eustachian tube.*

Side effects: *The literature primarily supports tympanic ventilation as both safe and effective. However, one author cautioned against employment of this technique while a patient has nasal congestion for fear of introducing nasopharyngeal secretions into the middle ear.* (Schwartz 1978)

Physiotherapeutic Modalities

Warm Oil Application

If there is no perforation in the tympanic membrane, for pain relief, heated oil drops (mineral oil, castor oil, mullein oil, garlic oil, etc.) may be placed in the affected ear every hour until relief is achieved (Cameron 1987, Hansen 1980, Tkac 1990).

Before administering any heated oil to an infant or small child, self-test the temperature of the oil by placing a drop on the sensitive skin of the anterior wrist.

Rationale: *It is felt that the application of warm oil exerts an anesthetic effect and will soothe a hot, inflamed and painful tympanic membrane.*

Side effects: *There are no known or reported side effects associated with this procedure. However, if the patient should experience a rapid increase in pain severity with this intervention, which rarely occurs, the oil should be removed immediately.*

Local Heat

The application of local heat has been used frequently for the relief of localized pain associated with earaches (Thrash 1981, Tkac 1990). It is a simple technique that may afford the patient immediate benefit, which is especially helpful in the case of infants and small children who are awakened in the middle of the night with an earache—they are usually uncooperative, distressed and difficult to manage. Application of a heating pad or using a hair dryer directly on the child's affected ear can calm and allow him/her to return to sleep. If using a hair dryer, periodically fan the dryer away from area of application to reduce heat buildup.

Be sure to monitor the heat application to ensure that it does not get too hot.

Application of heat is a simple, noninvasive and quick intervention that can be used effectively for temporary relief. Even though the symptoms may disappear entirely, there remains the possibility that underlying problems exist. In such cases, further evaluation of the patient by a clinician should be based on severity of the initial episode, objective findings at the time of presentation, and/or likelihood of recurrent episodes due to risk factors. (Cameron 1987, Thrash 1981, Tkac 1990)

Rationale: *It is felt that local heat applied to an earache has an anesthetic effect.*

Side effects: *There are no known or reported side effects associated with this procedure. However, if the patient experiences a rapid increase in pain severity with this intervention, which rarely occurs, the heat should be removed immediately.*

Over-the-Counter (OTC) Medications / Botanicals

Ear Drops

Ear drops can be used for their analgesic effect. A small number of clinical trials have investigated various types of ear drops for the pain of AOM in children. Despite the favorable natural history of AOM (approximately 80% spontaneously resolved within three days), immediate pain relief is desirable and both herbal and analgesic ear drops appear to confer fast-acting analgesia. They are inexpensive, easily administered, well-tolerated and they have no known side effects. The following ear drops have been studied and appear to be effective: 5 drops 3 times daily of an *herbal ear remedy* (Naturopathic Herbal Ear Drops) containing allium sativum, verbascum thapsus, calendula flores, hypericum perfoliatum, lavender, and vitamin E in olive oil (Sarrell 2001, 2003) and *analgesic ear drops* containing amethocaine and phenazone in glycerin (Sarrell 2001, 2003).

Effectiveness: *See Appendix I for a summary of the research.*

Analgesics and NSAIDs

The use of OTC medications for the management of pain and/or inflammation is a treatment option the clinician can pursue. However, more conservative options should be tried before an OTC intervention is considered. The decision to use OTCs should be based on the severity of patient complaints and/or objective findings.

Physicians considering a recommendation of a pharmaceutical intervention should apprise themselves of the clinical indications, contraindications, and adverse side effects or reactions.

NOTE: The use of aspirin in a febrile infant/child is contraindicated because of the danger of Reye's syndrome.

Effectiveness: *In a randomized control trial using 6-month to 12-year-old children, it was shown that using ear drops for pain control, ibuprofen for fever, and watchful waiting for 48-72 hours had similar outcomes as those initially treated with antibiotics. In fact, this approach substantially reduced unnecessary antibiotic prescriptions for children with AOM by 56%.* (Sprio 2006) (See considerations for referral on p. 30.)

(See Appendix V.)

Side effects: *Side effects of analgesics and anti-inflammatory medications are* ***not*** *uncommon and are well documented in the literature. However, before recommending or administering OTCs, one should consult a recent edition of a pharmaceutical text or the* Physician's Desk Reference.

Nasal Decongestants / Antihistamines

Nasal decongestants and antihistamines are not recommended as a treatment for OME.

No recommendations for or against have been made regarding antihistamines and decongestants for the treatment of AOM (Clinical Practice Guideline, Pediatrics AOM 2004). Additionally, these agents can cause adverse side effects such as insomnia, drowsiness, behavioral changes and seizures (Cantekin 1983, Dusdieker 1985, Haugeto 1981, Mandel 1987).

General Home-Care Advice

Home care advice for the management of the acute phase of ear pain should address the same identified therapeutic goals:

1. ameliorate symptoms,
2. clear the Eustachian tube,
3. diminish risks for future recurrence, and
4. in the case of OME with hearing impairment, optimize the listening–learning environment.

1. Treat symptoms

- **Heat, warm oil** (see p. 27) **or ear drops** (see p. 28) Olive oil, mineral oil, or a solution of diluted tea tree oil (1:10 with mineral oil) placed in the affected ear may soothe earache pain, as will the application of local heat. Patients can be instructed on the appropriate use of these interventions. (See Physiotherapeutic Modalities, p. 27.)

- **Analgesics/NSAIDs only as needed.**

- **Self administered soft tissue massage.** Physicians may instruct patients or parental guardians how best to perform this procedure at home. (See Soft tissue manipulation, p. 25.)

2. Clear Eustachian tube.

- **Autoinflation.** Physicians can instruct patients how best to perform this procedure at home. (See Autoinflation, p. 26.)

3. Prevent recurrence.

Prevention of AOM through the reduction of risk factors should always be a recommendation made by the treating physician. According to the AAP Subcommittee on Acute Otitis Media, "this recommendation is based on strong observational studies and a preponderance of benefits over risk." (Clinical Practice Guideline, Pediatrics AOM 2004) A similar approach can be applied to OME although there is less evidence.

- **Secondary smoke.** Reduce or eliminate exposure to second hand smoke (Clinical Practice Guideline, Pediatrics AOM 2004).

- **Infant feeding.** Continue breast feeding for at least the first six months. Avoid unattended supine bottle feeding and pacifier use during the first six months. (Clinical Practice Guideline, Pediatrics AOM 2004) It is unclear whether bottle feeding and pacifier use represent independent risks or are simply associated with decreased likelihood of breast feeding. Delay the introduction of solid foods to nursing infants until at least six months of age.

- **Day care.** Altering child care center attendance can reduce the incidence of upper respiratory tract infections and AOM significantly (Adderson 1998, Daly 2000, Clinical Practice Guideline, Pediatrics AOM 2004).

  For additional options see Risk Factors, pp. 7-8.

4. Optimize listening–learning environment in cases of OME

- Since decreased hearing acuity can be part of the OME presentation and the watchful-waiting period for this condition is up to three months, parental guardians should be instructed regarding specific strategies to enhance the child's listening–learning environment. The practitioner should provide the parental guardian with a list of useful suggestions (see Appendix III).

Clinical Endpoints and Outcome Measurements

- Pain resolves.
- Temperature returns to normal.
- Ear congestion resolves.
- Auditory acuity improves.
- Activity level and sleep pattern return to normal.

Considerations for Referral and/or Consult

- Infants less than 6 months
- Patients with fever above 102.2°F (39˚C) (oral temperature) or 100.4°F (38˚C) (rectal temperature).
- Infants/children 6 months to 2 years with a certain diagnosis of AOM (Clinical Practice Guideline, Pediatrics AOM 2004)
- Patients with severe illness
- Infants or children who may be dehydrated or presenting with severe symptoms:
    - severe pain
    - very ill, very agitated or listless appearance
    - neurological signs or symptoms
    - severe hearing loss
    - exquisite tenderness over the mastoid process elicited on exam
- For patients with AOM, failure of symptoms to resolve within 48-72 hours or if conservative measures fail to stem the progression of symptoms (progressive or persistent listlessness, pain, fever or congestion)
- Signs of mastoiditis (presence of an auricular mass, post-auricular swelling, edema or redness, tenderness with palpation) or other progressive infectious disorder
- Rupture of tympanic membrane
- Chronic OME (lasting longer than three months), which is not responding to treatment
- When OME persists for three months or longer, hearing testing is recommended. When children with OME demonstrate any language delay, learning problems, or a significant hearing loss, they should be referred to someone who specializes in these areas.
- Language testing is also recommended for children with OME and hearing loss. According to the AAP Subcommittee on Otitis Media with Effusion, “this recommendation is based on cohort studies and the preponderance of benefit over risk.” (Clinical Practice Guideline, Pediatrics OME 2004)

Antibiotic Therapy

Practice profiles have continued to evolve over the last 10 years. In light of increasing worldwide resistance of bacteria to antimicrobial drugs and the subsequent higher morbidity, mortality, and costs, it is not surprising that the healthcare community is concerned about the use of these drugs in the management of otitis media.

As far back as 1994, Rosenfeld in the British Medical Journal concluded

> ... existing research offers no compelling evidence that children with acute otitis media routinely given antimicrobials have a shorter duration of symptoms, fewer recurrences, or better long term outcomes than those who do not receive them. It is also not clear that routine compared with selective use of antimicrobials prevents complications. Thus it is prudent to reconsider routine use of antimicrobials for otitis media and to consider other approaches. (Rosenfeld 1994)

According to Dutch guidelines, antibiotic therapy should not be used unless the patient has significant ear pain, fever, or both for a period of 72 hours after seeking treatment, or if prolonged ear discharge develops (Dalhuijsen 1993).

A 2004 Cochrane review suggests that providing immediate antibiotic therapy in the treatment of otitis media has limited benefit. It goes further to suggest that 15 children would have to be treated for one child to receive benefit. (Glasziou 2004, Little 2006)

An RCT conducted in an emergency department environment also demonstrated that a wait-and-watch approach with prescription in hand could be used safely and would decrease the use of antibiotics in that patient population (Spiro 2006).

A 2006 meta-analysis of six RCTs including 1643 children aged from 6 months to 12 years, suggested antibiotics seemed to be most beneficial for children under the age of 2 with bilateral AOM and/or otorrhoea (Rovers 2006).

Parental (or patient) expectations have a strong influence on the decision to treat with antibiotics. For example, most patients with respiratory tract symptoms believe their illness is caused by infection and that antibiotic treatment is necessary (Mainous 1997). This belief influences antibiotic dispensing.

Well-designed studies have demonstrated that informed patients can make reasonable decisions about the risks and benefits of antibiotics. Shared decision making for AOM may lead to less antibiotic usage and higher levels of parental satisfaction (Merenstein 2005).

A brief explanation to parental guardians regarding the self-limiting nature of AOM and the issues regarding antibiotic prescription can have a strong influence on their decisions. In a randomized trial of children with AOM, a brief explanation by the family physician to the child's parental guardian about the disease and its expected spontaneous recovery decreased antibiotic use by 50% (Pshetizky 2003).

The explanation given during the PARQ can be short and should cover the following points (Pshetizky 2003):

1. AOM is part of an upper respiratory tract infection;
2. It has been well-established that in most cases children will recover regardless of antibiotic prescription;
3. Dangerously late complications from AOM may unfortunately occur regardless of whether antibiotics are or are not delivered in the course of the acute illness. Fortunately, it was demonstrated in one study that few of these serious complications arise when utilizing this conservative approach. Only one patient developed mastoiditis in a cohort of 5000 patients, and in that case the patient waited nearly a week before intervention. (Little 2006, van Buchem 1985)
4. Parental guardians can be instructed to administer analgesics as needed

according to the child's weight (see Appendix V).

5. In cases of persistent (over 48 hours) high fever [102˚F (38.8°C) or above] patients should be instructed to consult their primary care provider.

For patients where a combination of risk factor control and conservative care has failed to prevent a high rate of recurrence, there may be a role for long-term prophylactic antibiotics.

A systematic review of 13 randomized controlled trials involving 1358 high-risk children was performed (Leach 2006). A common definition of high risk in many of the studies was a recurrence rate of three episodes of AOM within the previous six months or four episodes within the last year. The review demonstrated an average 38% risk reduction of experiencing an episode of AOM (RR = 0.62, 95% CI 0.52 to 0.75 for any episode of AOM). Antibiotics prevented 1.5 episodes of AOM for every 12 months of treatment. The NNT was 5. Many of these children had an estimated future recurrence rate of around three episodes in the next year. The authors suggested that larger absolute benefits may be likely in children who have even more frequent or more severe AOM.

Long-term antibiotic care was defined as six weeks or longer. Dosage was 1-2 times per day. Of course, the benefits still need to be weighed against increasing antibiotic resistance and the cost and challenges of administering daily medication. Side effects to the antibiotics did not appear to increase significantly.

Management and Prevention of Chronic and Acute Recurrent Otitis Media

Patients with chronic otitis media require further evaluation to rule out other conditions such as allergy, adenoid tissue obstructing nose/nasopharynx, immunological disorders, or abnormalities such as occult cleft palate or tumor.

In some cases, treatment for chronic or recurrent otitis media may include prophylactic antibiotic therapy, oral steroid therapy, or surgical intervention (Nelson 1996).

Conservative methods to prevent acute recurrent otitis media and manage chronic otitis media consist of the same procedures utilized in the management of the initial, acute episode of otitis media, including control of variety of risk factors (see pp. 7-8). During acute recurrent episodes, daily, routine autoinflation of the middle ear is encouraged to promote drainage of fluid accumulation. As a prophylaxis against fluid accumulation in the middle ear space, this technique can be employed frequently throughout the day whenever the patient feels an acute episode is beginning. Additional dietary and nutritional steps may also be considered.

Dietary and Nutritional Options

- **Supplements.** Children deficient in certain nutrients are at risk for otitis media. Those nutrients most frequently implicated are vitamin A, zinc, and essential fatty acids. (Bondestam 1985, Chloe 1979, Hussey 1990, Jung 1988) RDA dosage supplementation is recommended for children who have a history of otitis media. Aside from the well-publicized contraindications for high dosages of vitamin A, there are no identified risks associated with supplementation or dietary modification.

- **Dairy.** There is data to support the correlation of childhood consumption of dairy products (specifically cow's milk) and increased likelihood of middle ear infections (Nsouli 1994, Saarinen 1983, Shapiro 1995).

- **Allergies.** Children with allergies or family history of allergies are reported to be more likely to contract middle ear inflammatory disorders. A role of food allergies in OME has also been suggested, but the exact incidence is unknown. (Bahna 1988, Hurst 1990, Nsouli 1994) At this time, strong supportive evidence of this proposed correlation is lacking (Clinical Practice Guideline, Pediatrics OME 2004). However, the practitioner and parental guardians may wish to explore the above options, especially in chronic or recurrent cases. Wheat, egg whites, peanuts, soy, corn, oranges, tomatoes, chicken and apples are the most frequently identified foods causing allergic responses in children (Nsouli 1994). Testing for specific food sensitivity can be performed on those patients with chronic or recurrent otitis media.

Appendix I: Research on Otitis Media and Ear Drops

Two randomized, double-blind controlled trials (Sarrell 2001, 2003) tested an herbal therapy for ear pain associated with AOM. Although the studies had different designs, they both compared treatment with herbal ear drops to anesthetic ear drops in children aged 5-8 years. Both groups showed significant reduction in pain over three days. Children in one group were given five drops of Naturopathic Herbal Ear Drops (NHED) (contents: allium sativum, verbascum thapsus, calendula flores, hypericum perfoliatum, lavender, and vitamin E in olive oil) three times daily. The herbal extract was as effective as anesthetic drops in reducing ear pain. The herbal remedy groups reported significantly less pain on day one. There was no advantage to prescribing antibiotics with either type of ear drops.

In another study (Wustrow 2004), 390 children aged 1-10 years presenting with uncomplicated AOM participated in a prospective, open, nonrandomized, controlled, parallel-group study. Children were treated with either (1) conventional therapy with combinations of decongestant nose drops, mucolytics, analgesics and antibiotics, or (2) alternative therapy with a fixed combination of plant-based tinctures and homeopathic medicine. Group assignment was based on provider decision (non-randomized). The alternative therapy group (of 192) had milder signs and symptom ratings than the conventional therapy group (of 193) at baseline. Conventional care patients took more antibiotics and analgesics. After adjusting for baseline group differences, the investigators found that outcomes (otoscopy, pain and symptom score) were similar in both groups. Both doctors and parents rated the alternative treatment to be significantly better tolerated than conventional treatment.

Herbal/homeopathic therapy may be an acceptable way to reduce the use of antibiotics or improve tolerance for a watchful waiting approach.

Another double-blinded study conducted with 171 children ages 5-18 suffering from ear pain and AOM demonstrated that the application of NHED significantly reduced ear pain after 30 minutes following application. Although, all participants in the study showed no clinically significant ear pain in a three-day follow up regardless of treatment. This is most likely due to the self-resolving nature of the condition. (Sarrell 2003)

Appendix II: Research on Otitis Media and Manual Therapy

Besides occasional case studies, there are only two larger studies reported in the literature as of the revision of this care pathway (2007).

Fallon's Case Series (1997)

This pilot study was a case series in a private office setting in which chiropractic high velocity low amplitude (HVLA) manipulation was performed on 332 children, ages 27 days to 5 years. A survey of the patient/guardian was used to determine historical data with respect to previous otitis media bouts, age of onset of initial otitis media, feeding history, history of antibiotic use, referral patterns, and birth history. Otoscopic and tympanographic data was collected as well as data concerning the number of adjustments administered to produce resolution of otitis media. Data with respect to recurrence rates over 6 months was also collected.

- Average number of adjustments: AOM (n=127) 4.0 ± 1.03, OME (n=104) 5.0 ± 1.53, mixed type of bilateral otitis media (n=10) 5.3 ± 1.35, and where no otitis was initially detected on otoscope and tympanographic exam (but with history of multiple bouts) (n=74) 5.88 ± 1.87.
- The number of days it took to normalize the otoscopic examination: acute 6.67 ± 1.9, chronic/serous 8.57 ± 1.96, and mixed 8.3 ± 1.00.
- The number of days it took to normalize the tympanographic examination: acute 8.35 ± 2.88, chronic/serous 10.18 ± 3.39, and mixed 10.9 ± 2.02.
- The overall recurrence rate over a six-month period from initial presentation in the office: acute 11.02%, chronic serous 16.34%, mixed 30%, and for none present 17.56%.

This pilot study had no control or evidence that the intervention was superior to the natural history of the condition.

Osteopathic RCT

A small random control study looked at the effects of osteopathic manipulation as an adjunct therapy to routine pediatric care in children with recurrent AOM. Their technique excluded HLVA manipulation and focused on balanced ligamentous tension, facilitated positional release, and/or counterstrain treatments. (Mills 2003)

The pool consisted of 57 patients ranging from 6-months to 6-years old with three episodes of AOM in the previous 6 months, or four in the previous year, who were not already surgical candidates. They were randomly placed into two groups: one receiving routine pediatric care; the other receiving routine care plus osteopathic manipulation. Both groups received an equal number of study encounters to monitor behavior and obtain tympanograms.

Clinical status was monitored with review of pediatric records. The pediatrician was blinded to the patient group and study outcomes, and the osteopathic physician was blinded to patient clinical course. Outcome measures included frequency of episodes of AOM, antibiotic use, surgical intervention, various behaviors, and tympanic and audiometric performance.

Adjusting for the baseline frequency before study entry, intervention patients had fewer episodes of AOM [mean group difference per month, -0.14 (95% confidence interval, -0.27 to 0.00); P=.14] fewer surgical procedures (intervention patients, 1; control patients, 8; P=.03), and more mean surgery-free months (intervention patients, 6; control patients, 5.25; P=.01).

Baseline and final tympanograms obtained by the audiologist showed an increased frequency of more normal tympanogram types in the intervention group, with an adjusted mean group difference of 0.55 (95% confidence interval, 0.08 to 1.02; P=.02). No adverse reactions were reported. The authors suggest a potential benefit of osteopathic manipulative therapy as adjunct therapy in children with recurrent AOM; it may prevent or decrease surgical intervention or antibiotic overuse. The study suffers from lack of placebo.

Appendix III: Improving the Learning–Listening Environment[§]

- Get within three feet of the child before speaking.
- Turn off competing audio signals such as unnecessary music and television in the background.
- Face the child and speak clearly, using visual clues (hands, pictures) in addition to speech.
- Slow the rate, raise the level, and enunciate speech directed at the child.
- Read to or with the child, explaining pictures and asking questions.
- Repeat words, phrases and questions when misunderstood.
- Assign preferential seating in the classroom near the teacher.
- Use a frequency-modulated personal- or sound-field amplification system in the classroom.

[§] Clinical Practice Guideline, Pediatrics OME 2004

Appendix IV: Manual Therapy Utilization Profile

Note that this utilization profile for otitis media presents which of the following interventions are most used by clinicians in WSCC clinics. It does not reflect best evidence from external sources. In some cases, procedures may be underutilized because of poorer familiarity on the part of the practitioners.

	Nearly always	Often	Seldom	Never/almost never
Endonasal	■■■■■	■■■■		
Autoinflation	■■■■■	■■■	■	
Cervical adjustment	■■■■■■	■■■		■
Auricular adjustment		■	■■	■■■■■■■
Lymph drainage massage	■■	■	■■■■■	■■

Appendix V: Dosage Information for OTC NSAIDs Use in Children

NSAID	Weight (lbs)	Age (yrs)	Dose
			tsp
Ibuprofen: Children's Motrin® or Advil® (Oral Suspension) Each teaspoon (5ml) – 100 mg Ibuprofen	24-35	2-3	1
	36-47	4-5	1 ½
	48-59	6-8	2
	60-71	9-10	2 ½
	72-95	10-11	3
			dropperful
Ibuprofen: Motrin® Drops Each dropperful (12.5 ml) = 50 mg Ibuprofen	24-35	2-3	2
			caplets
Ibuprofen: Jr. Strength Motrin® Caplets † Each caplet contains 100mg Ibuprofen	48-59	6-8	2
	60-71	9-10	2 ½
	72-95	11	3
† Not for use in children under the age of 6 years.			

NOTES:

Ibuprofen-containing products in the form of Nuprin/Motrin® IB, Advil® Tablets, Advil® Cold & Sinus, and Vick's DayQuil® Sinus are not appropriate for children under the age of 12 years.

Naproxen Sodium is not to be used in children younger than 12 years of age. Follow adult guidelines for children older than 12 years of age.

Ketoprofen is not to be used in children younger than 16 years of age. Follow adult guidelines for children older than 16 years of age.

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