

JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

# Acute Mastoiditis Clinical Pathway

Johns Hopkins All Children's Hospital

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*This pathway is intended as a guide for physicians, physician assistants, nurse practitioners and other healthcare providers. It should be adapted to the care of specific patient based on the patient's individualized circumstances and the practitioner's professional judgment.*

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# Acute Mastoiditis Clinical Pathway

## Rationale

This protocol was developed by a consensus group of ACH hospitalists, infectious disease physicians, and pharmacists to standardize the management of children hospitalized for acute mastoiditis. It addresses the following clinical questions or problems:

1. When to perform temporal bone imaging
2. How to interpret the results of temporal bone imaging
3. When to consult ENT, neurosurgical, or infectious disease specialists
4. Which empiric antibiotics should be used

## Background

Acute mastoiditis is a complication of acute otitis media (AOM). The middle ear cavity and mastoid air spaces are continuous. During an episode of AOM, the mucosa lining the middle ear, and often that lining the mastoid, becomes inflamed. In almost all cases, the inflammation resolves as the AOM improves. When inflammation persists, purulent material accumulates within the mastoid cavities (acute mastoiditis with periostitis). . As the pressure increases, the thin bony septae between air cells may be destroyed (coalescent mastoiditis).

## Diagnosis

The term “acute mastoiditis” refers to an infectious process which involves the mastoid air cells and causes bony destruction of the mastoid septa or the bony cortex. The typical clinical findings include fever (76%), malaise, severe ear pain (81%), ear displacement (proptosis), along with mastoid process erythema, tenderness, and fluctuance (85%).<sup>1</sup> [ Evidence level 1a, strongly recommended]

Lab tests: Blood cultures should be obtained, but are only positive in 14%.<sup>2</sup> [Evidence level 3b, strongly recommended]. A C-reactive protein (CRP) and sedimentation rate (ESR) are not required for diagnosis as they are no more useful than the physical examination. However, they may be useful for following the clinical response to therapy for one of the complications of acute mastoiditis, such as an undrained abscess or osteomyelitis.

Radiologic studies: CT scans or MRI can adequately look for the presence of mastoid inflammation, which appears as clouding of the middle ear cavity and the mastoid air cells. However, this particular finding is not specific for acute mastoiditis, as it also can be seen in children with uncomplicated otitis media of bacterial or viral causes. Findings consistent with

acute mastoiditis include haziness or destruction of the mastoid cortex or septa, periosteal thickening, or subperiosteal abscess. Extension to the brain is seen as cerebritis or a brain abscess, and to the sigmoid sinus as thrombosis. Studies which lack one of these specific findings are not supportive of a diagnosis of acute mastoiditis, even if the official radiology report uses the term “mastoiditis.” However, the lack of any mastoid septal destruction or other abnormalities is not specific enough to exclude the diagnosis of acute mastoiditis. CT is preferred over MRI, because MRI takes longer, is more likely to require sedation, is more expensive, and, most importantly, does not show bony defects as well as CT. CT or MRI should be performed with intravenous contrast in order to better delineate rim-enhancing abscesses and subtle areas of periosteal inflammation. [Evidence level 5 local consensus, recommended]

## **Clinical Management**

### Surgical consultations

Indications for consulting otolaryngologists include invasive disease that causes any subperiosteal abscess that might require a mastoidectomy, and uncomplicated mastoiditis (with CT evidence of septal erosion) for which a myringotomy can provide a specimen for culture. Indications for consulting neurosurgeons include epidural brain abscess, parenchymal brain abscess, and sigmoid sinus thrombosis. [Evidence level 5 local consensus, recommended]

### Antibiotic Selection

Since acute mastoiditis arises from otitis media, the most common causes of acute mastoiditis are *Streptococcus pneumoniae* (43-57%), *Streptococcus pyogenes* (5-31%), *Haemophilus influenzae* (0-13%), and *Staphylococcus aureus* (15%). Less common pathogens include *Moraxella catarrhalis*, *Pseudomonas aeruginosa*, and anaerobes. Up to half of middle ear fluid cultures are negative.<sup>3</sup> [Evidence level 4a, recommend]. A recent series from Colorado showed that from 2005-2008, in the post-pneumococcal vaccine era, only 38% of pneumococcal isolates exhibited intermediate resistance to penicillin (all in children  $\leq 2$  years old) and none had high-level resistance.<sup>3</sup> Therefore, most cases should be covered by ceftriaxone at a dose of 50-75 mg/kg daily. For patients with a history of severe allergy (i.e. anaphylaxis) to penicillins, consider using levofloxacin at a dose of 10 mg/kg (max 500 mg) given BID for children  $< 5$  years old and once daily for children  $\geq 5$  years old. [Evidence level 5a, strongly recommend]

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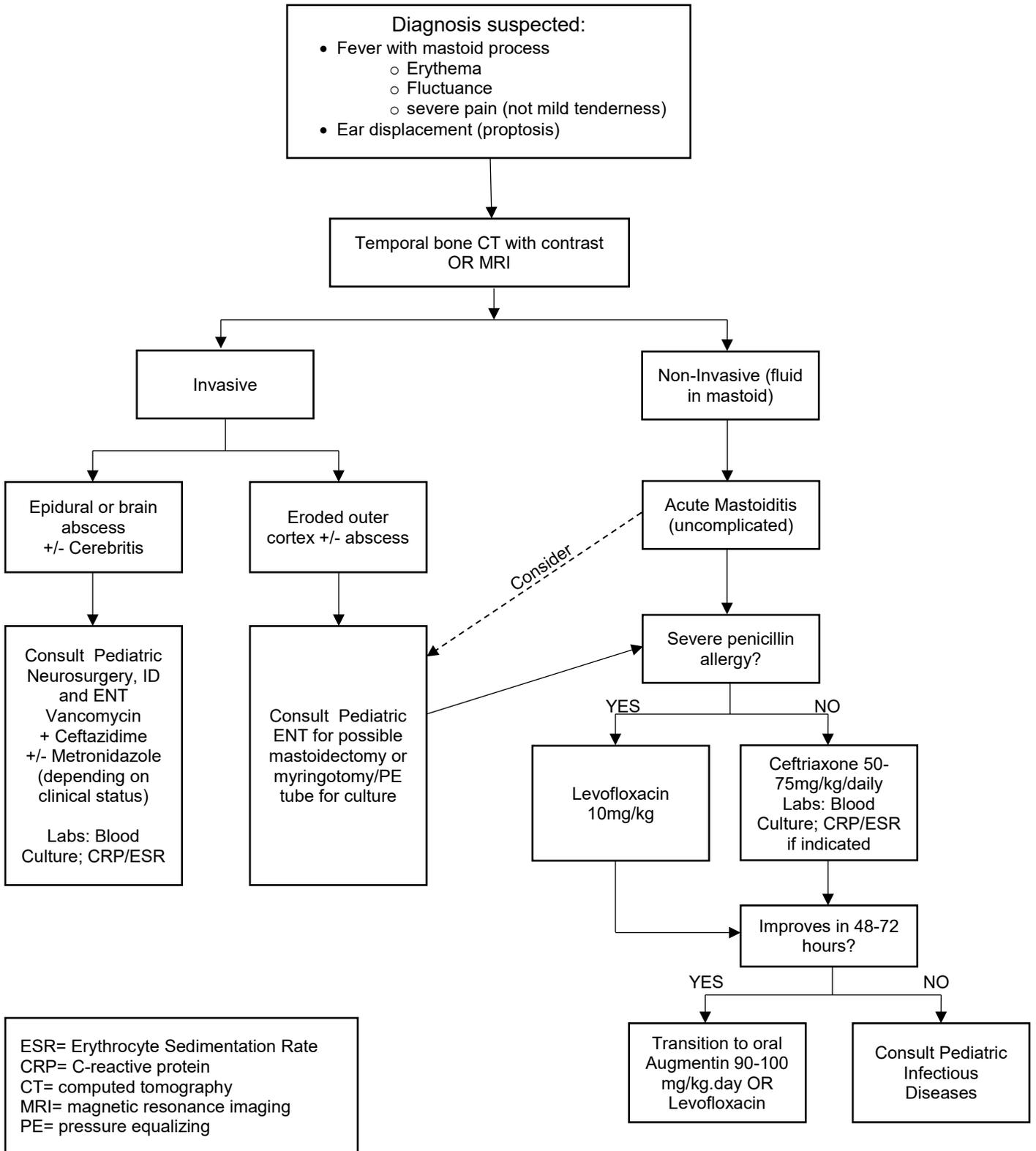


Table of Evidence Levels (see note above)

Quality level	Definition
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5a or 5b	Other: General review, expert opinion, case report, consensus report, or guideline
5	Local Consensus

†a = good quality study; b = lesser quality study

Table of Recommendation Strength (see note above)

Strength	Definition
“Strongly recommended”	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
“Recommended”	There is consensus that benefits are closely balanced with risks and burdens.
No recommendation made	There is lack of consensus to direct development of a recommendation.
<p><i>Dimensions:</i> In determining the strength of a recommendation, the development group makes a considered judgment in a consensus process that incorporates critically appraised evidence, clinical experience, and other dimensions as listed below.</p> <ol style="list-style-type: none"> <li>1. Grade of the Body of Evidence (see note above)</li> <li>2. Safety / Harm</li> <li>3. Health benefit to patient (<i>direct benefit</i>)</li> <li>4. Burden to patient of adherence to recommendation (<i>cost, hassle, discomfort, pain, motivation, ability to adhere, time</i>)</li> <li>5. Cost-effectiveness to healthcare system (<i>balance of cost / savings of resources, staff time, and supplies based on published studies or onsite analysis</i>)</li> <li>6. Directness (<i>the extent to which the body of evidence directly answers the clinical question [population/problem, intervention, comparison, outcome]</i>)</li> <li>7. Impact on morbidity/mortality or quality of life</li> </ol>	

## References

1. Van den Aardweg M, et al. A systematic review of diagnostic criteria for acute mastoiditis in children. *Otology and Neurotology*, 2008;29(6):751-7.
2. Nadal D, et al. Acute mastoiditis: clinical, microbiological, and therapeutic aspects. *Eur J Pediatr* 1990;149(8):560-4.
3. Halgrimson WR, et al. Incidence of Acute Mastoiditis in Colorado Children in the Pneumococcal Conjugate Vaccine Era. *Ped Infect Dis J* 2014;33

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## **Disclaimer**

*Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners and other health care providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.*

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