

# Diagnostic and Surgical Treatment Outcome of Acute Mastoiditis in Pediatric Age Group.

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## ABSTRACT

**Background:** The incidence of Acute Mastoiditis in children has diminished, but it is not uncommon in clinical practice. Clinical presentation includes a history of otorrhea, pain in the ear, post aural swelling, a shift in pinna position and tenderness over the mastoid. The etiology includes acute and chronic suppurative otitis media, trauma and rarely hematogenous infection. Otoscopy is difficult in this age group due to edema of the EAM skin, pain and non-cooperation. Temporal bone CT scan is very useful in evaluating the pathology in the middle ear cleft such as cortical necrosis, Ossicular erosion and Cholesteatoma. Conservative medical management is useful in tiding over the crisis but surgical exploration of middle ear cleft, eradication of the disease and Tympanoplasty alone leads to cure prevents recurrence. The study aimed at analyzing retrospectively clinical and etio-pathological characteristics of pediatric acute mastoiditis and mastoid abscess in 62 children and to plan a strategy for the management in our Hospital. **Methods:** Retrospective evaluation of the medical records of 62 children aged below 14 years was scrutinized to record demographic data, history, investigations, etiological factors and treatment outcomes to establish a treatment protocol for future adaptation. **Results:** 62 patient records were taken up in the present study; patients mean age was 9± 2.4 years. In 18 children (29.03%) previous history of CSOM was reported. All children had clear evidence of post-auricular inflammation. Other clinical features like shift in pinna position, otorrhea, fever and otalgia were noted. Increase in WBC count in 69.35% of the cases, anemia with Hb less than 8 gms% was noted in 19 (30.64%) patients. Total cell count more than 11000 was observed in 69.35% of the patients. C T scan temporal bones in the present study showed 11 (17.74%) children showed signs of Cholesteatoma, clouding of mastoid air cells was noted in 17 (27.41%) and 7 (11.29%) children presented intracranial complications. Immediate medical treatment with 3<sup>rd</sup> generation parenteral Cephalosporins, NSAIDS was initiated. Abscess drainage was done in 18 (29.03%) children. Cortical Mastoidectomy and/or MRM with Tympanoplasty were performed in 39 (62.90%) of the children. **Conclusion:** Surgical exploration of the middle ear cleft after initial stabilization of the child with medical treatment gave statistical significant cure rate with low recurrence rate. CT scan was significant in accurately diagnosing the mastoid involvement correlated per operatively in 71.79% of CSOM and 100% of ASOM in children undergoing surgical exploration. Surgical approach is required in cases of complications or failure of medical treatment. Watchful clinical monitoring to rule out intracranial complications is always essential in all patients with Acute Mastoiditis.

**Keywords:** Acute otitis media, acute mastoiditis, Children, Complications, bacteriology, staphylococcus, Mastoid abscess and Mastoidectomy.

## INTRODUCTION

There is a fall in the incidence of Acute Mastoiditis and Mastoid abscess since the advent of antibiotics and awareness of ENT specialist treatment. At the beginning of the 20<sup>th</sup> century, 50% of all patients of otitis media used to progress to coalescent mastoiditis. The incidence fell to 0.4% by 1959 and reached to present figure of 0.24%. During the time of Friedrich Bezold (1824-1908), 20% of the patients with mastoiditis developed a sub periosteal abscess.<sup>[1]</sup> Acute Otitis Media is the most common pediatric infections. While it has limited symptom duration, but sometimes may progress to suppurative complications with higher morbidity and even mortality.<sup>[2]</sup>

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The incidence is increasing in the recent past (10 years) evidence with reporting in the literature.

This may be attributed to increase in the increased resistance to the antibiotics and practice of conservative treatment and watchful waiting.<sup>[3,4]</sup> The incidence of Acute Mastoiditis in children under 14 years is nearly 1.2 to 4.2 per year in developed countries.<sup>[5]</sup> Sub-periosteal abscess (SA) is the commonest complication of Acute Mastoiditis.<sup>[6]</sup> It results from accumulation of pus in the mastoid antrum and air cells rapidly, causing coalescence of the air cells due to increase in pressure and inflammatory osteolysis of the trabeculae and outer cortex.<sup>[7]</sup> Parenteral antibiotics combined with retro-auricular puncture and grommet insertion is an effective alternative to Mastoidectomy in the treatment of acute mastoiditis with SA in children.<sup>[8]</sup> High grade fever; raised neutrophil count, High C reactive protein levels may be used as clinical and lab markers in the diagnosis of Acute Mastoiditis.<sup>[9]</sup> CT scan of temporal bones with or without contrast is a valid technique in detecting the bony pathology in Acute Mastoiditis, but its possibility of entraining a rise of pediatric brain radiation has raised questions about the necessity of using it.<sup>[10]</sup> CT scan has a sensitivity of 97% and specificity of 94% in detecting the intracranial complications.<sup>[11,12]</sup>

**MATERIALS AND METHODS**

All the medical records belonging to children aged below 14 years admitted with acute mastoiditis were retrieved from Medical records section and audited. The study period was between February 2013 and June 2015. The study was conducted at General Hospital attached to the Rajiv Gandhi Institute of Medical sciences (RIMS), Kadapa, A.P. The inclusion criteria: 1. All children aged below 14 years with acute symptoms and signs of acute mastoiditis irrespective of the underlying pathology of CSOM or ASOM. 2. Children with intracranial complications and immune deficiency states were included. Exclusion criteria: 1. Children previously undergone Mastoidectomy. 2. Children with external otitis and children with exanthema. History of present illness was elicited to include pre admission, treatment, duration of ear discharge, pain in the ear and fever. All the children were subjected to ENT examination, including otoscopy wherever possible. Clinical data concerning the age of the child, gender, history of ear discharge, Pain in the ear, Displacement of the pinna, otoscopy signs, surgical and medical treatments before and after admission were scrutinized. Bacteriological reports, HPE reports and CT scan reports and surgical procedures undertaken were reviewed. The diagnosis was based on the history, clinical signs and radiological findings in all the patients. Patients receiving parenteral antibiotics, use of NSAIDs and Myringotomy and Mastoid abscess incision and drainage as in patients were considered as conservative treatment. Children of this group were given Injection Ceftriaxone sodium 60 mgs/Kg body weight in 2 divided doses intravenously.

NSIAD diclofenac sodium or Paracetamol is given according to their age and body weight twice daily. Patients undergoing Cortical Mastoidectomy or Modified radical Mastoidectomy after initial medical treatment were considered as surgical management. All the patients were followed up for 18 months for evidence of recurrence, wound healing and graft uptake. The patients showing improvement in hearing and absence of ear discharge were considered as cured. Patients with the failure of graft up take, recurrence of acute mastoiditis and less than 10 dB gains in hearing loss were considered as failed treatment protocol and considered for revision of procedures. All the data collected was analyzed using Chi square calculator to know the statistical significance.

**OBSERVATIONS**

62 children presenting with symptoms and signs of Acute Mastoiditis were included in the present study. The youngest patient was 2 years old and the eldest child was 14 years. The mean age was 9± 2.4. 38 (61.29%) children were males and 24 children (38.70%) were females. Among the 62 children 46 (74.19%) belonged to the age groups between 7 and 14 years. All the patients (100%) had discharge from the ear for more than one year before presenting with symptoms of acute mastoiditis. Pain in the ear was complained in 56 (90.32%), and fever in 53 (85.48%) of the children. The mean of days before admission to this hospital varied from 08 in the age group of 7-9 years and to 11 days among children of 10-14 years of age [Table 1].

**Table 1:** Showing the age incidence and incidence of clinical features of Acute Mastoiditis (n=62).

Age Group	Number of patients 62	Male 38 61.29%	Female 24 38.70%	Mean days before admission (Days)	Fever >38 ° C 53 85.48%	Otorrhea 62 100%	Otalgia (56)-90.38%
0-3 Yrs	04	03	01	10	04	04	04
4-6 Yrs	12	06	06	09	10	12	11
7-9 Yrs	24	15	09	08	20	24- 38.70%	20
10-14 Yrs	22	14	08	11	19	22- 35.48%	21

Other parameters recorded in the case sheets showed that the children belonging to low socio economic group were 45 (72.58%), children with recent history of exanthema were 14 (22.58%) and previous myringotomy were 11 (17.74%). The

middle ear cleft disease in the form of ASOM and CSOM were reported in 23 (37.09%) and 39 (62.90%) respectively [Table 2]. History of previous repeated ear discharge was seen in 18 (29.02%) of the children.

**Table 2:** Showing other parameters like economic status, incidence of ASOM and CSOM (n=62).

Age Group	Low Socio Economic status-45	Exanthema 14- 22.58%	Tuberculosis-8- 12.90%	Previous Myringotomy-11- 17.74%	ASOM- 23 37.09%	CSOM- 39 62.90%
0-3 yrs	03	01	00	00	01	03
4-6 yrs	09	06	02	02	05	07
7-9 yrs	18	03	03	04	09	15
10-14 yrs	15	04	03	05	08	14

Meningeal signs were observed in 7 (11.29%) patients, out of which 3 were from CSOM group and 4 from ASOM group. Otoscopy showed a stage of perforation in 9/23 (39.13%), congested and bulging T.M in (34.78%) and Dull TM in 6/23 (26.08%) of the ASOM patients. Among the

CSOM patients central perforation was seen in 24/39 (61.53%), sub-total perforation in 8/39 (20.51%) and attic perforation in 7/39 (17.94%) of the children. Otoscopy was not possible in 2 patients [Table 3].

**Table 3:** Showing signs of Acute Mastoiditis with ASOM and CSOM (n= 62).

Age Group	Meningeal signs +ve- 06	ASOM-23			CSOM- 39			
		Stage of perforation 09	Congested bulging TM 08	Dull T.M 06	Central perforation 24	Subtotal perforation 08	Attic perforation 07	Otoscopy not possible 02
0-3 yrs	01	01	00	00	02	00	00	01
4-6 yrs	02	02	01	02	03	02	01	01
7-9 yrs	01	04	03	02	11	02	04	00
10-14 yrs	03	02	04	02	08	04	02	00

Signs of Acute mastoiditis such as displaced pinna in 60 (96.77%) and post aural edema in 100% of the children was seen in the study [Table 4].

10-14 yrs	22	13	03	02
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**Table 4:** Showing other signs of Acute Mastoiditis (n=62).

Age Group	Displaced pinna (60) 96.77%	Post aural edema- 62- 100%	Mastoid Abscess With CSOM	Mastoid Abscess With ASOM
0-3 yrs	04	03	00	02
4-6 yrs	12	09	05	04
7-9 yrs	22	18	07	04

Total Count (>9000 cells/cu mm) was observed in 22(35.48%), Hemoglobin less than 8 Gms% in 19 (30.64%) and Leukocytosis >9000 cells/cu mm in (53.22%) of the children. Staphylococcus aureus was cultured in 29 (46.77%), Klebsiella in 17 (27.41%), Pseudomonas aeruginosa in 8 (12.90%), E. coli in 3 (4.83%) and Streptococci in 11 (17.74%) of the specimens collected at the time of incision and drainage and during surgery [Table 5].

**Table 5:** Showing Lab investigations and microorganism in Acute Mastoiditis (n=62).

Age Group	WBC count >9000 cells/Cu mm	Hemoglobin 8 gms%	Leukocytosis Polymorphs- 65%	Staph aureus	Klebsiella	Pseudomonas. Aeruginosa	E. coli	Strepto cocci
0-3 yrs	01	01	01	01	01	00	00	01
4-6 yrs	08	06	09	08	03	02	00	04
7-9 yrs	06	07	11	11	07	01	02	02
10-14 yrs	07	05	12	09	06	05	01	04

CT scan temporal bones showed fluid levels in the middle ear and mastoid antrum in 11 (17.74%), soft tissue shadow in 12 (19.35%) together labelled as clouding of mastoids 24(27.4%) and erosion of Tegmen in 4 (6.45%), cortical fistula in 19 (30.64%) of the children. facial dehiscence was not observed in any of the CT scan of temporal bones [Table 6].

Conservative medical management was adopted in 25 (40.32%) patients. Among these 8 (12.90%) underwent myringotomy and medical treatment. 18 (29-03%) children underwent Incision and drainage of the post aural abscess and medical treatment. 18/25 (48%) of these children came with

recurrence and failure in control of ear discharge was found in them [Table 7].

Cortical Mastoidectomy was done in 21 (33.87%) of the patients and MRM was done in 16 (25.80%) of the children. In all these 37 patients, Tympanoplasty was done depending upon the Ossicular damage and underlay grafting. Failure in graft uptake and persistence of ear discharge was seen 6/37 (16.21%) children after a 3 months follow up. No recurrence in mastoiditis was observed this group.

**Table 6:** Showing the Radiological signs of Acute mastoiditis (n=62).

Age Group	ASOM-23 Positive CT scan signs 23/23		CSOM-39 Positive CT scan signs 28/39				
	Fluid levels	Soft tissue shadow	Erosion of Tegmen	Erosion of sinus plate	Facial dehiscence	LSCC dehiscence	Cortical fistula
0-3 yrs	00	01	00	00	00	00	
4-6 yrs	01	01	01	01	00	00	05
7-9 yrs	04	04	02	01	00	00	07
10-14 yrs	06	06	02	02	00	00	07

**Table 7:** Showing the medical management with recurrence in Acute Mastoiditis patients (n=25).

Age Group	Medical treatment 25	Failure with recurrence 18	Myringotomy	Abscess drainage
0-3 yrs- 4	02	02	00	02
4-6 yrs- 12	06	03	02	04
7-9 yrs- 24	08	06	02	06
10-14 yrs- 22	09	07	03	06

**Table 8:** Showing the surgical treatment and the results (n=37).

Age Group	Cortical Mastoidectomy 21	MRM 16	Tympanoplasty 37	Failure of graft 06	Chi square statistic P value
0-3 yrs- 4	00	00	00	01	Chi 8.3226
4-6 yrs- 12	02	03	09	01	P 0.003916
7-9 yrs- 24	10	06	18	02	
10-14 yrs- 22	09	07	17	02	

The Chi square statistic is 8.3226 The P- value is 0.003916 (significant P Value is taken as 0.05) There is statistical significance between the patients managed only by conservative method and definitive surgical procedure undertaken. Hence, in Acute Mastoiditis conservative management has no role to achieve a higher cure rate [Table 8].

### DISCUSSION

Acute Mastoiditis is more of an intra temporal complication of ASOM rather than CSOM occurs as a result of virulent organisms or due to lowered immunity in the patient. It is due to inflammation of the Mucoperiosteum of the middle ear and the mastoid air cell system, resulting in a collection of serous or mucoid or purulent fluid in the middle ear cleft. Build up of pressure within the cleft following bacterial invasion causes coalescence of air cells and cortical bone necrosis. It is common in paediatric age group and left untreated, may lead to life threaten intracranial complications. Early recognition, investigation and institution of appropriate treatment lead to a satisfactory outcome. Although complications of Acute Otitis Media have decreased in occurrence since the introduction of newer antibiotics, they are seen

infrequently in children and remain still a serious complication with life-threatening consequences.<sup>[13]</sup> The complications may include sometimes meningitis, epidural, subdural, and intra parenchymal abscesses, vascular thrombosis, osteomyelitis and abscesses deep within the neck it may present as the first evidence of ear disease. The main symptoms are pain, fever, or otorrhea that persists despite appropriate treatment.<sup>[1,2]</sup> Children due to pain and apprehension do not allow otoscopy and hence clinical diagnosis is based on the presence of retro auricular swelling, erythema, or protrusion of the auricle plus evidence of coexistent recent otitis media.<sup>[13]</sup> The present study was retrospective review of case sheets of 62 such children attending the General hospital attached to RIMS, KADAPA with either Acute Mastoiditis or Mastoid Abscess. The clinical features, demographic information and radiological studies and treatment schedules adopted in treating the children are analyzed. In addition, a detailed protocol was developed in the light of the findings of the study for early diagnosis, imaging classification of the local inflammatory disease and diagnosis of associated complications and finally the management. CT scan pictures in Acute Mastoiditis show non-enhancing soft tissue shadows, fluid levels, Ossicular destruction, and

loss of trabeculae, cortical defects and involvement of Tegmen and Dural plates. The sensitivity of CT scan in the diagnosis of acute mastoiditis is reported as 87 to 100%.<sup>[14]</sup> Improvement in socio economic status in all countries has resulted in reduction in incidence of CSOM, but the incidence of complications of CSOM remained same. Hence, these studies suggest that the increase in incidence of acute mastoiditis is following ASOM rather than CSOM.<sup>[14,15]</sup> The current treatment of mastoiditis is mainly antibiotics with surgery reserved to myringotomy.<sup>[16,17]</sup> Mastoid abscess may develop as a complication of mastoiditis following both AOM and COM.<sup>[18,19]</sup> It occurs when purulent material collection accumulates within the middle ear and mastoid air cells, and it is often accompanied by granulation tissue. Surgical intervention is still the most common treatment for mastoid abscess. Therefore, it is important to distinguish mastoid abscess from uncomplicated mastoiditis and manage patients accordingly. In the present study the commonest presentation was erythema post aural skin, displaced pinna, swelling post aurally and induration. Fluctuation in the swelling of post aural region in these cases denoted abscess formation in 15/39 (38.46%) of the CSOM patients where as 12/23 (52.17%) ASOM patients showed an abscess formation in the study. 3 children each with (3/23) ASOM and CSOM (3/39) showed intra cranial complications like meningitis, Cerebellar abscess and Cerebral abscess. The complications occur more rapidly in children presenting with ASOM and mastoiditis or abscess.<sup>[20]</sup> In the present study, patients with mastoid abscess following mastoiditis were treated as Inpatients and given I.V. 3<sup>rd</sup> generation Cephalosporins according to their body weight. A high-resolution CT of the temporal bone and contrast-enhanced CT of the brain were also performed in all patients. Mastoidectomy following abscess drainage was indicated when there was purulent collection clinically, evidence on the CT scan or in patients with Cholesteatoma. Commonest organism isolated from the pus drained during Incision drainage or Mastoidectomy were Staph aureus 19 (30.64%), Klebsiella 17 (27.41%), Pseudomonas aeruginosa 8 (12.90%), streptococci in 11 (17.74%) and E. coli (04.83%). There was no predominance of any type of organism in ASOM or CSOM. The cultures were negative in 13% of the patients. Prior antibiotic treatment before admission may be the cause for the negative cultures in the present study, which was similar to the study by Benito et al Studies in the past have shown that commonly in AOM include Streptococcus Pneumonia and Haemophilus sp were isolated, whereas in CSOM they included Proteus mirabilis, Enterococcus spp., and Pseudomonas aeruginosa.<sup>[13,16]</sup> Definitive surgical exploration was done after the child is stabilized and canal wall up or down procedure is

decided on exploration of the Mastoid cavity depending on the Cholesteatoma matrix invasion into the attic and Ossicular chain erosion. In the present study 21/62 Cortical Mastoidectomy and 16/62 MRM were performed. Rapid spread of infection resulting in children can be explained by type and virulence of the bacteria, host resistance, and the adequacy of treatment.<sup>[21]</sup> Children undergoing conservative management showed a failure rate of 18/25 when compared to 6/37 children who underwent definitive surgical management with cortical or MRM operations. This was found to be statistically significant in the present study. The P value was at 0.003 with a significance of P value taken at 0.05. Therefore, early adequate medical management with definitive surgical exploration of the mastoid antrum and middle ear irrespective of age would prevent further complications and at the same time give a significant cure rate. If broad spectrum antibiotics are used alone without surgical intervention a smouldering temporal bone infection with minimal clinical symptoms and signs leads to development of latent mastoiditis.<sup>[22]</sup> If the response to medical treatment is not significant within 48, it warrants immediate surgical exploration. The aim of such surgery includes effectively draining the pus, removing granulation tissue in the auditus and antrum which helps in reducing the edema of the middle ear cleft and re establishes the ventilation between middle ear and antrum.<sup>[20]</sup>

## CONCLUSION

Acute Mastoiditis in Paediatric age group is still prevalent in this part of Andhra Pradesh. It is presenting as a complication of both ASOM and CSOM. Most common clinical presentation was pyrexia, Otalgia, erythema post aural skin and displaced pinna. CT scan temporal bones were useful in the diagnosis and planning of surgery with specificity of 100% in Acute Mastoiditis with ASOM and 71.79% in Acute Mastoiditis with CSOM. Definitive surgical management with mastoid exploration, eradication of the disease in the middle ear cleft with Tympanoplasty is statistically significant in achieving cure rate and low recurrence rate with a P value of 0.0039 with expected P value of 0.05.

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