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Acute mastoiditis: Increase of incidence and controversies in antibiotic treatment

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SUMMARY

An important complication of acute otitis media is acute mastoiditis which responds to antibiotic therapy and myringotomy. Patients with acute mastoiditis were reviewed during 1996-2005 in the tertiary University Children's Hospital in Madrid. The number of patients with acute mastoiditis increased by about 2-fold during this period. Of 205 children with mastoiditis, ranging from 0.6-17 years of age, surgical treatment was needed in about 4.3% in 1996 and in 70% in 2005. In spite of 80% of the children having received antibiotics at the pediatric visit, the number of complications increased (periostitis, subperiosteal abscess), and the number of surgical interventions increased by 8-fold. Etiological agents were Streptococcus pneumoniae (28.5%) and Staphylococcus aureus (16.3%). Negative cultures were obtained in 53.6% of cases. Lack of response to conventional therapy may require more tympanocentesis procedures for a middle ear culture, and surgical therapy may be necessary more often, as is the tendency in our hospital.

Key words: Acute mastoiditis - Antibiotic policy - Acute otitis media

Mastoiditis aguda: aumento de su incidencia y controversias en el tratamiento antibiótico

RESUMEN

La mastoiditis aguda es una complicación importante de la otitis media aguda que responde al tratamiento antibiótico y la miringotomía. Se realizó un estudio de revisión de los pacientes con mastoiditis aguda que acudieron al Hospital Infantil Universitario Niño Jesús de Madrid, de nivel terciario, durante 1996-2005. El número de pacientes con mastoiditis aguda aumentó aproximadamente dos veces durante este periodo. De los 205 niños registrados con mastoiditis, con una edad de 0,6 a 17 años, se requirió tratamiento quirúrgico en cerca del 4,3% en 1996 y en el 70% en 2005. A pesar de que el 80% de los niños recibieron antibióticos al visitar al pediatra, el número de complicaciones aumentó (periostitis, absceso subperióstico) y el número de intervenciones quirúrgicas fue hasta ocho veces superior. Los agentes etiológicos identificados fueron Streptococcus pneumoniae (28,5%) y Staphylococcus aureus (16,3%). Los cultivos fueron negativos en el 53,6% de los casos. Según la tendencia observada en nuestro hospital, la falta de respuesta a un tratamiento convencional puede requerir un mayor número de procedimientos de timpanocentesis para los cultivos de oído medio y la necesidad de realizar un tratamiento quirúrgico con mayor frecuencia.

Palabras clave: Mastoiditis aguda - Política antibacteriana - Otitis media aguda

INTRODUCTION

Upper respiratory tract infections (common cold, pharyngitis, otitis media, sinusitis) are the most common diagnosis at the pediatric visit. Most of them have a viral etiology in spite of antibiotics often having been prescribed. Spontaneous clinical resolution of symptoms occurs in 81-86% of acute otitis media cases, in 90% of streptococcal pharyngitis and in 69% of acute sinusitis cases (1).

Cochrane reviews and other studies (2-4) reveal the uncertain role of antibiotics in upper respiratory tract infections in pediatrics and do not recommend antibiotics as a first choice when the etiology is still of unknown origin. The risk of serious complications has been studied. Acute mastoiditis is a serious complication of acute otitis media, but it can be treated successfully in most cases with broad-spectrum intravenous antibiotics and myringotomy.

The most frequent diagnosis that is made at the pediatric visit is acute otitis media. Since 1999, the number of patients presenting at the emergency room with acute otitis media has not changed; however, complications due to this condition have increased by about 2-fold. In the last 5 years we have seen an increase in complicated cases of otic infections and occurring more frequently. Most of them needed either surgery and a long course of antibiotic treatment (3-6 weeks) or a long course of antibiotic treatment. Surgical interventions have increased by 8-fold since 1999.

An example of the clinical course is as follows: a child around the age of 2 years begins with a common cold, afterwards develops symptoms suggestive of acute otitis media, which then leads to a more severe condition and complications due to chronic otitis media, mastoiditis, mediastinum abscess and epidural abscess. More serious complications such as meningitis are scarce, even though clinicians are aware and decide nearly always to prescribe antibiotics.

During the first half of this decade, there has been much interest in limiting the unnecessary use of antibiotics for acute respiratory infections (2, 3, 5). Reducing antibiotic consumption by delaying administration by 48 hours indicates that there is no significant difference between immediate and delayed administration.

Some important questions should be asked. Could a restrictive antibiotic policy be the cause of an increase in severe and more complicated cases? Is this restrictive antibiotic policy a protective measure to ensure antibiotic efficiency? Could thousands of upper respiratory tract infections which are undertreated result in the occurrence of a few but important serious infections? Although there is a strong causal link between antibiotic use and resistance

patterns, is there enough evidence that we could reverse resistance problems by changing the recommendations for antibiotic use?

The common cold is caused by viruses although physicians often prescribe antibiotics in the belief that they will prevent secondary bacterial infections and, in some cases, they also respond to patient demands (2).

In our experience, there is not enough evidence of important benefits from treating upper respiratory tract infections with antibiotics to warrant their routine use in children, and also there is a significant increase in adverse effects associated with antibiotic use (rash, abdominal pain, diarrhea, vomiting). A small proportion of patients come to the hospital looking for medical advice, including parents of a child with purulent rhinitis, which is a very common problem in young children. If a clear nasal discharge becomes purulent, we may think it is worsening or developing into sinusitis. However, antibacterials are never required in this context since all types of rhinitis are viral, even those with a purulent discharge. Culturing the discharge often reveals the growth of suspected pathogens, *Streptococcus pneumoniae*, *Haemophilus influenzae* or *Staphylococcus aureus*. They are not causative agents but rather their own flora, or colonizers, and should be ignored. Some studies (1, 2) have not shown any benefit for antibiotics as a prophylaxis or treatment of purulent rhinitis.

Acute otitis media usually follows a nasopharyngeal viral infection. Signs and symptoms are poorly predictive. Acute otitis media diagnosis should be based on careful examination of the tympanic membrane (6, 7) and meet the following criteria: rapid onset, presence of middle ear effusion and inflammatory signs.

The second step is the diagnosis of acute otitis media with effusion, which is also a viral infection and antibiotics should not be prescribed unnecessarily. Observation without antibiotics and close follow-up is an option (1, 3, 7). Parents should be advised to watch the child, recognize signs of worsening and be able to provide prompt access to medical care if improvement does not occur. In general, if there is no improvement within 48-72 hours antibiotic therapy should be prescribed.

The "wait and see" approach in the management of acute otitis media is feasible and can result in a 76% reduction in unnecessary antibiotic prescriptions (8). About 80% of cases of acute otitis media will resolve in 1 week (7) without antibiotic treatment.

Mastoiditis is the most common and feared complication of acute otitis media. In the last decade many authors (9, 10) have documented an increasing frequency of acute mastoiditis in children due to a lack of antibiotic treatment

Table 1. Incidence of patients with acute mastoiditis during 1996-2005.

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cases/year	11	12	14	25	23	25	17	25	23	30
Miringotomy	0 (0%)	1 (8)	1 (7%)	2 (8%)	2 (8.5%)	3 (12%)	4 (23.5%)	4 (16%)	3 (13%)	5 (50%)
Miringotomy + mastoidectomy	0 (0%)	0 (0%)	0 (0%)	1 (4%)	1 (4%)	2 (8%)	2 (12%)	4 (16%)	5 (22%)	6 (20%)
Global surgery	0 (0%)	1 (8%)	1 (7%)	3 (12%)	3 (13%)	5 (20%)	6 (35%)	8 (32%)	8 (34%)	21 (70%)

as routine for acute otitis media episodes. This and other life-threatening complications will be discussed in this article.

MATERIAL AND METHODS

During 1996-2005, 205 patients diagnosed with mastoiditis were studied. Age ranged from 6 months to 17 years (mean 3.21 years), 67.4% were under 3 years of age, 145 (69.3%) were male and 66 (30.7%) were female.

Previous upper respiratory tract infectious disease, previous treatment, clinical evolution, microbiological data and complications were reviewed.

RESULTS

Eighty percent (80%) of the patients had been treated with antibiotics before they were admitted. Only 10% had no history of an antibiotic prescription. Acute mastoiditis was diagnosed in all patients. The number of patients with mastoiditis doubled during this period (Table 1), while the general population presenting at the Pediatric Emergency Room remained unchanged.

Surgical treatment was required in 4.3% of patients in 1996-1997 and increased to 33% in 2003-2004, with 70% needing surgery in 2005. From 0% mastoidectomies at the beginning of the study, there were 20% in 2005. During the 10 years of the study, a total of 56 patients (26%) had surgery, while the remaining 149 patients (73%) received antibiotic treatment without surgery. The number of surgical interventions was 8-fold higher in 2005 than in 1999.

Mastoidectomy, which was performed in this study more frequently than in other studies (11), was necessary in 4% of the patients in 1996-1997 and in 33% of the patients in 2003-2004.

Clinical evolution

Although most patients (80%) had received previous antibiotic treatment, complications of periostitis and sub-

periosteal abscess occurred in both treated and nontreated patients at a similar rate.

Latency between onset of symptoms and acute mastoiditis differed substantially. Patients with less severe symptoms had less suspected diagnosis of acute mastoiditis in spite of mastoiditis being the first clinical sign (middle ear infection) in more than 50% of our patients. This outcome was most prevalent in younger infants (51.4%).

Twenty-one patients (10%) had one or more complications of mastoiditis: 15 patients had subperiosteal abscess, 1 had facial nerve palsy, and 9 had intracranial complications such as meningoencephalitis, sigmoid or lateral sinus thrombosis, subdural abscess, cerebella, abscess and petrous apex supuration with cavernous sinus thrombosis.

Microbiological diagnosis

Microbiological diagnosis (Table 2) was based on cultures taken from 44% of the total population studied. It was done in only a few cases in 1996-1998 (14%), but since 1999, the number of bacterial diagnoses increased with 93% of cultures performed in 2005.

Negative results were found in 56 of 95 cultures, representing 53.7% of the total number. From 1996 until 2004, 55.28% of cultures were negative (37/67) and in 2005,

Table 2. Microorganisms isolated.

	1996-2004 (%)	2005 (%)	Total (%)
<i>Streptococcus pneumoniae</i>	7 (23.3)	7 (36.8)	14 (28.5)
<i>Streptococcus pyogenes</i>	5 (16.6)	2 (10.5)	7 (14.2)
<i>Haemophilus influenzae</i>	2 (6.6)	6 (31.5)	8 (16.3)
<i>Pseudomonas</i> spp.	6 (20.0)	1 (5.2)	7 (14.2)
<i>Staphylococcus aureus</i>	8 (26.6)	0	8 (16.3)
Anaerobes	1 (3.3)	1 (5.2)	2 (4.1)
<i>Moraxella catarrhalis</i>	1 (3.3)	0	1 (2.0)
Other aerobes		2 (10.5)	2 (4.1)
Total	30 cases	19 cases	49 cases

50% were negative. From 1996 to 2004, 30 of 67 cultures were positive (44.7%). Cultures done in 2005 resulted in 50% positive cultures. In the total sample, positive cultures were obtained in 46.31% of cases. Negative cultures were reported in about half of the patients (46.26%) during the 10-year period and positive cultures were recovered in 45.2% during the study period.

The most common pathogen (Table 2) was *S. pneumoniae* in 14 isolates (28.5%), with increasing frequency (7 isolates [23.3%] in 1999-2004 and 7 isolates [36.8%] in 2005). The same rate of penicillin-susceptible and -resistant *S. pneumoniae* was found. Methicillin-sensitive *S. aureus* was found in 8 isolates (16%), *H. influenzae* in 8 isolates (16%), *Streptococcus pyogenes* in 7 isolates (14%), *Pseudomonas* spp. in 7 isolates (14%), other anaerobes (4%), *Moraxella catarrhalis* (2%) and other aerobes (4%).

Antibiotic treatment

Antibiotic treatment before entering the hospital was prescribed in 80% of the patients (7) and all the patients who entered the hospital also received antibiotic treatment. Antibiotics were prescribed following the empirical guidelines recommended by the hospital's Antibiotic Committee: cefotaxime in 73% of patients, co-amoxiclav in 16.5% and ceftriaxone in 10.8%.

DISCUSSION

In the era before antibiotics, acute mastoiditis was the most common complication of acute otitis media, with more morbidity and mortality. With the widespread use of antibiotics since 1940, the incidence of acute mastoiditis decreased until during the 1980s (12), when reports revealed a sharp increase in frequency.

It has not been proven if a delay in diagnosing acute otitis media results in acute mastoiditis or if a middle ear disease with subclinical signs (mostly in infants) could be the cause of mastoiditis. It is also not known if delayed or nonelective antibiotic treatment, because of the microorganisms or because of resistance, could also lead to failure and a more complicated prognosis.

Current evidence does not suggest an increased risk of complications when otitis media is managed by delaying antibiotic treatment, and routine antibacterial therapy of otitis is not an absolute guarantee against mastoiditis and other complications. Prior antibiotic therapy ranged between 36% and 87% in other studies (11, 13), and in our study, 80% of patients received antibiotics.

The introduction of antibiotics as a routine treatment for acute otitis media has also shown that some patients manifest signs of otitis in the tympanic membrane which may have disappeared by the time acute mastoiditis is diagnosed and can delay diagnosis as a masked mastoiditis (11).

Patients who received antibiotic treatment at the sign of first symptoms had a higher incidence of negative culture results. In our series, negative cultures represented 54% of the total samples, but in 1996 no cultures were taken in 14 cases, in 1998 only 2 samples from 14 cases were taken, in 2001, 12 of 25 and in 2005, 28 microbiological diagnosis of acute mastoiditis were made from 30 cases (Table 2).

There was no statistical difference in complications of periostitis and subperiosteal abscess development between treated and nontreated patients, showing that antibiotic treatment was not a safeguard against complications of middle ear infections (14).

CONCLUSIONS

There has been a progressive increase in the incidence of acute mastoiditis and an increase in surgical treatment, with 8-fold more interventions than years before. High levels of resistance and new and more aggressive pathogens (*S. aureus*, *S. pneumoniae*) have resulted in more failures of conventional antibiotic treatment and, therefore, tympanocentesis for middle ear culture may be more profitable and more frequently used in cases of antibiotic failure. A better antibiotic policy, acute diagnosis and surgical diagnosis and therapy should also be implemented more often in the future.

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