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Otitis media and language development

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OTITIS MEDIA AND LANGUAGE DEVELOPMENT

By

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CHAPTER I

INTRODUCTION: RATIONALE AND PURPOSE

Over 400 years ago, Paracelsus said, "diseases wander here and there the whole length of the world. He who understands them must wander too." The past several decades in the fields of otology, audiology and speech pathology have been years of wandering and obtaining knowledge. The dynamics of recent developments and discoveries are overlapping. The medical field, particularly the area of otology, has been making advancements in the areas of diagnosing, treating and preventing middle ear infections. Chronic otitis media has been a condition of such magnitude as to warrant undertaking major efforts in its prevention and control. The recent developments of audiology in the past decade have contributed and supplemented the medical field's knowledge. The use of impedance measurements as an indicator of possible middle ear pathologies has contributed phenomenally to the best health care possible for individuals with middle ear dysfunctions. It has been documented that fluctuating hearing losses oftentimes accompany middle ear pathologies. What has not been recognized for nearly so long is the effect of otitis media on the overall well being of the child

afflicted--not only by virtue of the annoyance and discomfort, but also in the unknown (and only recently suspected) effects this condition may have on the child's learning potential, language development, cognitive processing, and overall educability, physiologically as well as psychologically. Therefore, the purpose of this paper is to explore the limited research findings available on the effects of otitis media during infancy and preschool years on learning potential, language and cognitive development. Specifically, first there will be a definition of otitis media and its various clinical manifestations. Then the literature regarding specific speech and language skills, learning potential, and cognitive processing is reviewed which suggests the fact that otitis media accompanied by fluctuating hearing losses does cause deficits in the above mentioned areas. Lastly, rehabilitation proposals and suggestions are presented in hopes of contributing to the overall best health care of a child.

Otitis media is an inflammation of the mucoperistoeal lining of the middle ear cleft. The middle ear cleft is a collective anatomic term for the eustachian tube, tympanic cavity, attic, mastoid antrum, and mastoid air cells. The middle ear cleft communicates with the atmosphere via the eustachian tube. Normal aeration of the middle ear cleft is maintained by an incompletely understood physiologic activity of the eustachian tube which permits opening of the tubal lumen to equalize pressure and to facilitate the normal

movement of the secretions out of the middle ear cleft by the cilia of the lower tympanic cavity and eustachian tube. The eustachian tube is a common route of possible infection in children.

Otitis media is typically differentiated into serous, acute, and chronic otitis media. The terms refer to various conditions in the middle ear space which, when inflamed, may be coincident with mastoiditis since the mastoid air cell system openly communicates with the middle ear.

Serous otitis media occurs when the eustachian tube becomes closed or blocked thus creating a closed middle air space.[1] Under these circumstances, the air of the middle ear is absorbed creating negative middle ear pressure and transudation of the fluid into the cavity. Hearing impairment may be present due to the retracted tympanic membrane and negative middle ear pressure, and/or due to the presence of fluid. Hearing levels may be relatively normal and currently impedance audiometry is the best technique for demonstrating abnormalities of the middle ear system due to this condition. Serous otitis media is very common in children aged three to eight years and may be rather recalcitrant to medical treatment. If pain is present in this disease, the pain is usually intermittent and rather mild.

Acute otitis media generally presents suddenly with ear pain, which may as suddenly subside when the tympanic membrane ruptures.[2] The middle ear secretion in this disorder

is purulent. The pain which accompanies this ear condition often makes audiometry and impedance testing difficult, if not impossible. Parents often describe young children as "pulling at their ears."

Chronic otitis media oftentimes includes purulent discharge from an ear with a perforation of the tympanic membrane.[3] Chronic otitis media is a recurrent disease. The tissues of the middle ear intermittently undergo destruction, healing and scarring during the recurrent infections. This disease may also be the result of a cholesteatoma. Chronic otitis media most often has its onset in early childhood, between the ages of five and ten years. A fluctuating mild to moderate hearing loss often accompanies chronic otitis media.

The audiologist's involvement with identifying otitis media depends somewhat on the setting--working in an otolaryngologist's office, to screening children in school and rural settings. Pure tone screening is often the audiologist's role in the schools. This procedure identifies some of those children who suffer a hearing loss secondary to otitis media, but, oftentimes does not identify those children with mild or fluctuating hearing losses. The problems inherent in mass screening programs are evident to professionals in this field. Impedance measurements are a valuable diagnostic tool for identifying middle ear problems, without concomitant hearing loss; a function conventional

audiometry cannot perform.

Tympanometry is an objective technique for measuring the compliance, or mobility, of the tympanic membrane as a function of mechanically varied air pressures in the external auditory canal.[4] Tympanic membrane mobility is of particular interest since almost any pathology located on or medial to the eardrum will influence its movement. The otolaryngologist routinely creates air pressure against the eardrum with a pneumatic otoscope, and makes subjective judgments regarding the mobility of the tympanic membrane. Tympanometry, however, is more objective than the otolaryngologist's eye, and the air pressures involved with the techniques are small compared with those typically generated by the pneumatic otoscope. Often, eardrums noted to have normal mobility by pneumatic otoscopy examination, can be shown to have abnormal mobility with tympanometry.[5]

The compliance of the tympanic membrane is at its maximum when air pressures on both sides of the eardrum are equal. That is, the eardrum achieves its best mobility when the air pressure in the external auditory canal is exactly the same as the existing air pressure in the middle ear. The knowledge of middle ear pressure is important clinical information. When the process of aeration in the middle ear is halted, as in prolonged closure of the eustachian tube, the now static air in the middle ear space is absorbed by the blood vessels in the mucosal lining.[6] This situation produces negative air

pressure in the middle ear space causing transudation of fluid and retraction of the tympanic membrane. If the aeration process of the middle ear cavity is blocked for an extended period of time, fluid may totally fill the middle ear space. Thus, the early identification of negative middle ear pressure may permit the physician to practice preventive medicine and avoid the condition of otitis media.[7]

The presence of unequal pressures on either side of the tympanic membrane usually occurs when negative pressure exists in the middle ear space. This may be sufficient to cause a retraction of the eardrum accompanied by a mild conductive hearing loss in spite of the fact that no fluid may be observed in the patient's middle ear. Jerger[8] and Liden et al.[9] have described basic tympanogram patterns and related them to conditions of the middle ear. Jerger's classification system of tympanometry curves can also be labeled "pressure compliance functions."[10] For simplicity, Jerger ascribed alphabetical letters to each type of curve. And, even though this classification is convenient, a description of each tympanogram in terms of its dynamic compliance and the air pressure at which maximal compliance is noted appears more explicit.

The acoustic reflex usually disappears at a very early stage of otitis media, due to the gross increase in impedance. In the early stages, however, when the tympanogram still indicates elevated middle ear pressure, one may observe the reflex if care is taken to hold air pressure at the exact peak of the

tympanogram. In later stages, when the tympanogram illustrates the absence of a peak, or point of maximum compliance, reflexes are virtually eliminated.

Tympanogram shape, statis compliance, and the acoustic reflex, are all useful in monitoring the patient's recovery from otitis media. As the otitic ear heals, the tympanograms gradually return to the normal shape, and progress can be usefully monitored. Finally, when the acoustic reflex returns, a near normal middle ear mechanism may be assumed. And, as will be explained, a normal middle ear mechanism during critical language learning years (birth to two years)[11] is essential for normal speech and language development which is the foundation for later learning.

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CHAPTER II

EPIDEMIOLOGY OF OTITIS MEDIA

The purpose of summarizing the literature of the epidemiology of otitis media is to alert speech and language pathologists and others to those various age, sex, race, socioeconomic factors, and seasonal variations that appear to relate to the incidences of middle ear disease. Eagles[12] conducted several hearing screening surveys on school-age populations. He concluded that preschoolers, as well as very early school age (grades one to three) children are at high risk ages for the onset of middle ear disease. In reviewing the literature for the incidence and prevalence rates of middle ear pathology by sex, a slightly higher risk for males was often reported, however, this differential rate by sex remains of questionable statistical significance within studies. Otitis media does not appear to be significantly prevalent in any one race, with the exception of a slightly higher incidence in Indians. On the basis of available evidence, it appears that populations with striking contrasts in socioeconomic status will exhibit parallel contrasts in severity and/or prevalence of purulent middle ear disease. These differences may be attributable to a combination of high risk environmental

conditions and difficulty of access to medical care. A consistent pattern of seasonal variations in the incidence of otitis media has been reported in diverse populations in contrasting geographical areas. The consensus of these reports documents peak rates in the winter and early spring months, and a low rate in midsummer. The effects of geography and climate certainly bear more investigation. Suchs[13] has suggested that high humidity and low altitudes are related to high incidence of both upper respiratory and middle ear infections (including serous), but no other studies on these climate factors were uncovered. There appears to be fairly widespread agreement that periods of variable weather, rather than general temperature levels are predisposing environmental factors in the development of middle ear infections.

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CHAPTER III

OTITIS MEDIA: LANGUAGE AND LEARNING DEVELOPMENT

How does a middle ear infection affect a child? The medical implications have been defined, and audiometrics have documented that a fluctuating hearing loss often accompanies a middle ear infection but, does a mild loss have any effects on the child, particularly in the areas of language and learning development?

No satisfactory quantitative definition is available as to what constitutes a handicapping hearing loss. Reports show that the handicap of "deafness" is well understood and quantified. For example, the Committee on Nomenclature of the Conference of Executives of American Schools for the Deaf[14] developed an agreed-upon definition for the deaf as follows:

> Those in whom the sense of hearing is nonfunctional for the ordinary purposes of life. The general group is made up of two distinct classes based entirely on the time of the loss of hearing. a) The congenitally deaf: those who are born deaf. b) The adventitiously deaf: those who were born with normal hearing but in whom the sense of hearing becomes nonfunctional later through illness or accident.

However, when it comes to "partial impairment of hearing" the definitions in the past have been unrealistic, and ambiguous.

The hearing needs of a prelingual and language learning child are different than those needs for an adult: the following discussion will be on the former. Where school age children are concerned, Eagles[15] defined a hearing impairment handicapping if the loss is 26 dB (ISO 1964) and greater. At less than 26 dB he states that there will be "no difficulty with faint speech." More recently a National Academy of Sciences[16] report questioned the use of a 26 dB criterion for a hearing handicap in children, stating that mild hearing deficits in the speech range are of functional significance in terms of impairing educability. On the basis of this report a survey in Washington, D.C., by the National Academy of Sciences,[17] utilized a 15 dB (ISO 1964) criterion for a significant hearing loss. An accumulation of evidence[18] in the past few years strongly upholds the use of this lower criterion, and necessitates marked changes in estimates of the prevalence of the handicap of hearing loss. It seems as though we have been vastly underestimating in the past the numbers of children who should have been included in the review of handicapping hearing impairments. It is possible that instead of one in one thousand, one in seven may come within the concern for identification as well as habilitation.[19] The crucial delineation lies in how we define a handicapping hearing loss. If a hearing loss is defined only in terms of a decibel loss, then one is limited to the fragmentary audiograms or complete lack of auditory response

found in the totally deaf. However, if one defines hearing impairment as an impairment of communication and language comprehension and expression, due to any reduced auditory acuity, one is looking at an entirely new scope of events. Therefore, the remainder of this paper will focus on a redefinition of the handicap of a hearing loss; and the ramifications of a hearing loss on speech, language and cognitive development.

An acceptable method of measuring the effect of a hearing loss secondary to otitis media is to apply school achievement and language tests to experimental and control populations. Such studies are accumulating in the literature. Ling, in 1970,[20] compared achievement test results on two matched groups of school children; one group had hearing losses ranging from 15 to 45 dB, with histories of otitis media. The other group had no hearing loss or history of otitis media. The two groups were carefully matched for age, intelligence and environmental factors. The tests revealed that by nine or ten years of age, the fifteen children in the otitis media group was retarded by fifteen months in reading skills, sixteen months in mechanical arithmetic and nineteen months in problem arithmetic. The degree of retardation was positively correlated with the severity of the loss, but even the children with the mildest losses showed significant academic handicaps.

Further demonstration of the effect of very mild losses

was made by Quigley[21] in 1970. His study of Illinois public school children with mild to moderate hearing impairments showed that children with hearing losses less than 26 dB suffered measurably in their academic progress. Even those with hearing levels of 15 to 26 dB scored significantly lower than those with hearing better than 15 dB, in all language related subtests of the Stanford Achievement Tests.

In an exhaustive longitudinal study of 489 Eskimo children from birth to 10 years, Kaplan[22] identified almost 60 percent with a history of one or more episodes of otitis media during the first 2 years of life. All the children were given WISC Intelligence Tests, the Bender-Gestalt tests for perceptual problems, the Draw-A-Person Test, and most were given the Metropolitan Achievement Test. Those with a history of otitis media before two years of age and hearing levels of 26 dB or greater had statistically significant loss of verbal ability and were retarded in total reading, total math, and language. Even with hearing losses less than 26 dB, the children with early histories of otitis media showed significantly lower achievement and verbal scores than the normal group, and the gap tended to widen with increasing age. The incidence of these mild losses may be greater than has been heretofore estimated, if one can generalize from the Eskimo population.

But the mild, static hearing loss is not the only offender. Holm and Kunze[23] investigated the effects of fluctuating

hearing acuity experienced in recurrent and chronic otitis media. They studied an experimental group of children five and one-half to nine years old who had no other medical problems but middle ear disease which had its onset before the age of two, and which had been accompanied by fluctuations in hearing levels ranging from normal levels to greater than 25 dB. A matched control group of sixteen children with no otitis media history was used for comparison. Each group was given a battery of tests, including the Illinois Test of Psycholinguistic Abilities, the Peabody Picture Vocabulary Test, the Templin-Darley Picture Articulation Screening Test, and the Mecham Verbal Language Development Scale. The results showed that the performance of the otitis media group was significantly deficient in most of the tests requiring the receiving or processing of auditory information or the production of a verbal response. But in tests requiring visual skills the two groups showed no differences. In addition, all language skills were retarded in the otitis media as compared with the control group. The authors expressed deep concern that the presence of fluctuating hearing levels from otitis media during early critical periods may be considered insignificant by physicians who are not alert to the educational implications of such losses.

Marion Downs[24] believes that the presence of fluctuating hearing levels from otitis media during early "critical" periods are significant. She labels a child who has experi-

enced fluctuating hearing levels secondary to otitis media during the critical language learning years as "An Irreversible Auditory Learning Disaster."

Again, according to Downs,[25] a measure of what she calls an "Irreversible Auditory Learning Disaster" is the Illinois Test of Psycholinguistic Abilities, because it attempts to distinguish between auditory learning skills and visual learning skills. She used a sampling of three children who would have passed a 25 dB screening test at any time during childhood, but had otitis media during their first two years of life. They illustrated distinguishing differences between the way they processed auditory material and the way they handled visual material. However, caution needs to be employed on these interpretations. The Illinois Test of Psycholinguistic Abilities may not be the best measure of processing differences in auditory and visual channels. Also, there were only three subjects used, and no control group for these findings to allow for other interpretations to be drawn.

A pediatrician, Dr. Virgil Howie,[26] has long observed the phenomenon of impaired intellectual development in children with early otitis media. In a longitudinal study, he compared forty-four matched pairs of children, one group having had no otitis media in the first year of life, the other group having at least three recorded episodes of otitis media in the first year of life. The degree of loss accompanying the episodes of otitis media was not reported. He found there is a statistically

significant difference between mean intelligence quotients of the two groups.

When a child had six bouts of otitis media or more, Dr. Howie referred to him as otitis-prone. These children comprised 14 percent of a population of 488 children in his practice. All of these children had had their initial episode of otitis media in the first eighteen months of life. None of the children who had five bouts or less had developed otitis media that young.

An otitis-prone child may be considered an "Irreversible Auditory Learning Disaster" for two reasons. The first is concerned with the nature of speech sounds. What we think of as the total energy of speech resides largely in the vowel sounds and the voiced consonants. But the unvoiced consonant sounds have very little speech energy, and indeed many of these sounds in rapid conversation fall below the threshold of the normal ear. It is through contextual strategies and familiar transients that we unconsciously are able to fill in for these missing sounds. The infant or child who does not hear these sounds clearly is not able to learn all the strategies necessary to understand them. He becomes an incomplete auditory receptor--unable to put together all the speech sounds in their proper relationship.

The second reason for an "Irreversible Auditory Learning Disaster" is that the critical periods for laying the basis of language skills occur in the first two years of life--a

time when the prevalence of otitis media reaches its peak.

Scientists such as Hebb[27] and Forgus[28] pinpointed the crucial importance of early experiences. Forgus' theory holds that "the organization of adult behavior is largely determined by the quality of infant experience and learning." Hebb's concept was that early learning actually produces permanent changes in the structure of the central nervous system, primarily the cerebral cortex.

There is indeed neurological evidence that changes in the number of synapses in various brain areas underlie critical period events that take place during development. For example, Valverde,[29] studying the visual cortex of mice, found that there were fewer sites for the dendrites to receive synaptic input from other neurons in mice reared in darkness than in normal light-reared mice. When the mice were exposed to light later in life, some new sites formed, but the number never reached that of the normal light-reared mice. The same deficiencies occurred in cats reared in darkness who showed up to 20 percent less dentritic material than light-reared cats.

More recently a study at the Kresge Hearing Research Laboratory[30] has found similar results in rats that were given conductive hearing losses at birth. At six weeks neuronal comparison was made with a normal matched group. The globular cells of the ventral cochlear nucleus and the neurons of the medial nucleus of the trapezoid body were

significantly smaller in the experimental group. There were also significantly fewer neurons in the dorsal cochlear nucleus of the experimental group than in the normal group. This appears to be support for the irreversibility of the "Irreversible Auditory Learning Disaster." However, until controlled studies concerning the effectiveness of rehabilitation with children who have suffered otitis media during their first two years of life have been conducted, the term irreversible is erroneous. And the fact that animal research can be generalized to human functioning is also debatable.

From these studies that concern the effects of environmental deprivation it seems as though one could conclude that there is indeed a syndrome of auditory learning problems. A psychologist, Eisen,[31] has proposed after observing the learning problems of a child who had had early otitis media, a syndrome which he called the "Quondam hard-of-hearing child"--the child who at one time had had a hearing loss. That one time involved repeated otitis media during the early critical periods of language learning, the first two years of the child's life.

Few studies are available which relate psychosocial adjustment and mild hearing impairment, but some indication of the possible trends may be gathered from a study by Fisher[32] on fifty children with hearing losses of 20 to 64 dB. Both this group and a control group were given the Bristol Social Adjustment Scale. Forty-seven percent of the hearing impaired

children and 28 percent of the controls were judged abnormally adjusted on this scale. In addition, the hearing impaired children showed significant retardation in all basic school subjects. Fraser[33] found no association between degree of loss or type of loss, and degree of maladjustment. He noted that impaired hearing, poor adjustment and scholastic failure may interact to produce retardation out of all proportion to the degree of hearing loss. If extrapolation can be made from studies on early language deprivation, then hearing handicap is more age-dependent than it is degree of loss dependent. Heber and Garver[34] and Dennis[35] have demonstrated that the deprivation of high quality language input in the first two years of life makes a difference of 30 to 50 points in the child's eventual intelligence quotient. Insofar as we can postulate that the deaf child as well as the child with mild hearing loss receive a reduced quality of language input during their first years of life, their potential abilities and intelligence quotients performances will also be reduced. Additional information concerning psychosocial adjustment and related learning skills is the fact that the "intricacies" of speech must be taken into consideration. Speech sounds are the symbols by means of which understandable impressions are transmitted from one person to another. The actual meaning of a series of speech sounds may be altered considerably by the manner of spacing them or by the expression of the speaker. The beauty of the spoken word and much of its emotional content

depends upon how it is spoken, not only upon which sounds follows the other. The subtle differences of rising inflections and emphasis are tonal in character and exist in the low frequency region. These are the details which provide the feeling of realism and contact with the speaker and environment. When low frequencies are sacrificed, as is often the case with otitis media, the understanding may be decreased because of less interest and therefore, possible less effort on the part of the listener as well.[36]

On the basis of the evidence presented in this paper, even though the studies were occasionally poorly controlled, and gross generalizations were made, the following conclusions can be drawn.

Deprivation of normal auditory reception from birth to early school years can result in significant retardation in speech and language development, impair the general academic and emotional maturation of the child and foster assorted behavioral problems. The severely handicapped child is most often identified, but a child with a conductive loss resulting from middle ear infections is too often labeled backward or inattentive, or a discipline problem.[37] Both parents and teachers may fail to recognize and act upon the symptoms and source of the problem. A neglected child may unnecessarily progress into adulthood "at risk" both educationally and socially. No precise determination of the level and duration of impairment which constitutes an educational and social handicap has been made.

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CHAPTER IV

CONCLUSIONS

1. The prevention of otitis media and associated hearing, language, and speech impairments must begin well before the age that routine public or preschool audiometry might indicate that such problems exist. The screening of infants and very young children for otitis media must, therefore, be carried out by medical doctors and other qualified professionals. Should such a disease be detected, appropriate referrals should be made to those individuals qualified to provide definitive diagnostics, treatment, and follow-up care, including audiology and speech pathology. Therefore, a close working relationship is needed between professionals to furnish the necessary monitoring of a child's condition. Doctors' offices, hospitals and well-baby clinics appear to be appropriate settings for early identification. However, children are seen in mass, and not every child has the opportunity to obtain these services. A high risk register, including pertinent checklists that include socioeconomic status, sex, race, and illnesses, may alert physicians to subtle clues of the disease, as well as

educate parents and other professionals. Routine impedance measurements as a part of every regular medical checkup may also contribute to a thorough diagnostic workup. If, in fact, such a program could be practiced, important data regarding otitis media and variable hearing losses could be collected.

2. A hearing impairment should also be defined both in terms of physical measurement and in numbers, as well as the duration and age of episodes of otitis media. Thus, one might redefine that a hearing impairment, or handicap, in a child occurs when the following conditions exist:
   a. a hearing loss of 15 dB average (500, 1K, and 2K) or worse;
   b. the recurrence of otitis media in the first two years that persists for a period of a total of six months--(not necessarily all at one time--but, six months total when the child was deprived of complete auditory sensory input);
   c. fluctuation in hearing levels due to recurrent otitis media, with the hearing worse than 15 dB more than half the time over a six-month period;
   d. because the intelligibility and interpretation of speech sounds are crucial, and often impaired due to the hearing loss secondary to otitis media, speech audiometrics in addition to pure tones, are essential when possible--in quiet and noise. Objects instead of

conventional pictures may facilitate responses in younger children. Play conditioning sessions to voice prior to the final diagnostic evaluation may also be another method to more definitive results in toddlers.

3. These redefined hearing impairments should be treated appropriately and vigorously.
   a. Downs and J. C. Johnson[38] have suggested a mild gain hearing aid for the children afflicted. However, they have had difficulty justifying the value and expense of amplification for mild losses. Rather, an aggressive home stimulation program and energies directed towards educating parents, particularly mothers because of the great amount of time they share with their young child, appears to be a practical solution. In probably the same amount of time a family adjusts to hearing aids and receives appropriate hearing aid orientation sessions, a language stimulation program could be initiated, without the extra expense and prostheses.
   b. Again, medical and possibly surgical procedures are necessary, and prerequisite to a treatment program.
4. Even though treatment of a conductive hearing loss may leave the child free from a hearing deficit, educational problems can still occur because of the hearing loss during the child's critical language learning period.

Rehabilitation programs carried out concurrently with appropriate medical/surgical procedures essentially need to be designed to prevent learning problems secondary to otitis media. Objectives of this rehabilitation program designed for school age children should primarily include:

a. counseling of both parents and teachers on the problems related to otitis media and the variable hearing losses;
b. the effects of distance on audibility and preferential classroom seating;
c. ensure teacher awareness of the loss (or history of loss) and the need for special care in oral teaching (phonic approach) which has shown to be effective.[39]

5. According to the references cited in this paper, a lack of appropriate stimulation during a critical period of development results in a reduced function of the deprived sensory organ, not only at the time of deprivation, but throughout the life of the individual. In order to consider the above statement as a "truism," a longitudinal study needs to be conducted to determine if the periodic sensory deprivation experienced by these children is sufficiently debilitating to produce continuing lack of responsiveness to sound and permanent language deficits. If not, it would be of interest to ascertain how long the deficit persists after normal hearing is established. Perhaps the term "Irreversible

Auditory Learning Disaster" as used by Downs, could then be modified to read "Temporary Auditory Learning Disorder."

6. Of immediate concern to professionals now, is the fact that enough evidence exists to support that otitis media and the accompanying hearing loss do probably affect the child's speech and language development which would ultimately affect the child's cognitive processing, learning potential, and overall educability. Because children suffer otitis media during their first years of life, deprivation of quality, preverbal language stimuli and problems with awareness of auditory stimuli can occur. And, because this early deprivation appears to create significant deficits in language abilities and verbal performances, the following questions need to be addressed:
   a. How effective is intervention during the first years of life for the otitis media hearing impaired child?
   b. Is there a critical period during the disease and/or the development of the child in which intervention is maximally effective?
   c. What aspects of the early mother-infant communication systems are most relevant to the otitis media hearing impaired child's acquisition of language?
   d. After the fact, what remedial procedures are most effective?

Otitis media accompanied by fluctuating hearing losses can cause depressed language skills, lower performance on verbal

tests which consequently affect overall intelligence quotients, and possibly, overall maladjustment in academic, scholastic, and social achievements. There is some evidence that this auditory dysfunction may be irreversible. Therefore, early identification, treatment, and habilitation services appear not only crucial, but dictate necessarily a new role for the professionals involved. Physicians and audiologists are contributing to proper treatment, and identification; now the speech pathologist needs to become a more active member of this team to continue with the best possible health care for the otitis-prone child.

REFERENCES

38. Glorig and Gerwin, Otitis Media.

39. Ibid.