Otitis media in laboratory rats*

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Seventy-five of 260 Long-Evans rats (29%) were found to have middle ear infection, otitis media, when examined postmortem. The incidence of disease was found to increase with age of S and to be higher in females, as well as in animals subjected to stereotaxic brain lesions. It is suggested that several precautions be observed when using rats in auditory studies.

A frequently made assumption in auditory studies is that the rats selected for study have normal hearing. Studies revealing the possible invalidity of this assumption date back 40 years or more. McCordock and Congdon (1924) and Nelson and Gowen (1930) found middle ear infection (otitis media) in some colonies to be as high as 50%, with a significantly higher incidence in adult animals.

No recent information reporting the incidence of otitis media in laboratory rats as a function of age could be found by the writers. It was, therefore, the purpose of this study to observe the incidence of otitis media in a colony of Long-Evans rats at 1-10 months of age at monthly intervals. These data provide the E information as to optimal age and other criteria when using laboratory rats for auditory experimentation.

METHOD

Subjects

The Ss, acquired from the East Carolina University Psychology Department colony, consisted of 260 Long-Evans rats that ranged in age from 1 to 10 months at the time they were sacrificed and examined. The original breeding stock was acquired from Budd Mountain Rodent Farm, Chester, New Jersey, in January of 1969. All rats were housed in standard metal cages with a 16-h light, 8-h dark cycle. Thirty-one of the rats examined had been used in stereotaxic brain lesion studies, while the others had never been subjected to any form of research. The animals involved in the stereotaxic brain lesion studies were housed individually and food deprived throughout their respective experiments. This was usually from age 90 days to the time they were sacrificed. All other animals were housed in groups of two to six.

Procedure

Following sacrifice, middle ear explorations were performed on all Ss. The procedure used for exposing the middle ear cavity involved decapitating the animal, removing the mandible, exposing the tympanic bullae by removing the surrounding fascia, and then drilling through the bony bullae to expose the

middle ear cavity. Otitis media, manifested by a greenish-yellow purulence within the middle ear cavity, was observed by the naked eye at necropsy.

RESULTS AND DISCUSSION

Of the 260 Ss examined, 75 (29%) were found to be infected. Figure 1 shows the incidence of otitis media at the various ages. A chi-square analysis revealed a significant difference in the incidence of the disease as a function of age ($\chi^2 = 23.36$, $df = 9$, $p < .01$). Examination of Fig. 1 suggests an increasing incidence with increasing age. A significant biserial correlation between age and disease incidence confirms this observation ($rb = .29$, $p < .001$).

The incidence of otitis media was compared in males and females. Twenty-seven of 118 males, or 23%, and 48 of 142 females, or 34%, were found to be infected. A chi-square analysis does differ with respect to sex ($\chi^2 = 4.60$, $df = 1$, $p < .05$), the incidence being higher in females. Further, of the 75 infected animals, 33 had bilateral infections, while the remaining 42 rats had unilateral infections. Of the 33 animals with bilateral

Fig. 1. Number of Ss at different ages found to have otitis media. Twenty-six Ss were examined in each age group.

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infections, only 6 were males and 27 were females. A chi-square analysis of the incidence of unilateral and bilateral involvement in the diseased male and female rats revealed the proportion was not the same in the two sexes ($\chi^2 = 8.12$, $df = 1$, $p < .01$). Infected females are more likely to have a bilateral lesion than are infected males.

A final analysis was performed to test the difference of disease incidence within brain damaged and normal rats. It was found that 15 of 31, or 48%, of the animals used in stereotaxic brain lesion studies had otitis media, whereas only 60 of the 229, or 26%, of the normal animals had the disease. The incidence of the disease in the two groups was found to be significantly different ($\chi^2 = 6.51$, $df = 1$, $p < .02$). As the diseased animals' age range in both groups was similar, it is unlikely that age is a contributing factor to the differing incidences observed in the normal and brain operated animals. Since all of the operated animals had stereotaxic surgery which involved placing ear bars into the ear canals, it is not known whether the increased incidence of otitis media is due to an infection or stress produced by the ear bars or to surgical trauma per se.

The incidence of otitis media observed in the present study is comparable to that observed in other colonies and in other strains of rats. It has previously been shown that the incidence of the disease does not differ in Long-Evans and Holtzman animals (Daniel et al, in press). Also, Freudenberg (1932) reported a 36% incidence in the Wistar strain, and Retzlaff et al (1960) reported a 10% incidence in the Sprague-Dawley strain. Thus, it appears that rats in general are highly susceptible to otitis media.

The results of the present study, along with observations of the other investigators mentioned, suggest that certain precautions be taken when using rats for auditory studies. First, the Ss should be examined

for the presence of the disease. This can be accomplished before and after the collection of behavioral data with x-ray equipment (Grice et al, 1955) and also postmortem with middle ear explorations. Unfortunately, the structure of the rat's middle ear makes otoscopic examination inadequate for determining the presence of otitis media. Second, the use of older rats for auditory studies seems unwarranted due to the high incidence of the disease in older animals. Third, caution should also be taken in using females in that the disease tends to manifest itself not only more frequently but also more severely in females. Fourth, if the laboratory rat has been utilized for stereotaxic brain lesion studies, extra caution should be taken due to the increased incidence of the disease in operated animals. Finally, if middle ear examinations are not conducted, it is strongly recommended that intense auditory stimulus values be used in experiments employing rats as Ss.

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