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Screening programs: What effects could hearing tests for newborns have?



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The overwhelming majority of children can hear well. However, about 1 to 3 out of 1,000 children in Germany are born with a moderate or more severe hearing impairment. Only a minority of these children are completely unable to hear (“deaf”). The risk of having a hearing problem is higher in some groups of babies, such as those who are born too early (preterm or premature babies). When a baby is born with a hearing impairment it is called congenital hearing loss. It can be inherited, or an infection before birth could have damaged the hearing, for example. Hearing can also be damaged later, for example through serious ear infections or general viral infections. This is called acquired hearing loss.

This video (URL: <http://www.informedhealthonline.org/index.780.en.html>) shows how the ear works. If a newborn baby has poor hearing, only a few signals from the inner ear reach the brain. This might mean that the brain cells responsible for hearing are underused and may not develop properly. If that happens, hearing might be affected permanently, so it might be very difficult to make up for this later on. Children who do not hear well often learn to speak later than other children. This might affect their overall ability to learn, as well as their general personal and social development.

It is hoped that early treatment, for example with a hearing aid, could prevent some of these consequences of congenital hearing loss. The average age at which hearing impairment is diagnosed is somewhere between 21 months (just under 2 years) and 4 years of age, or even later. To try to diagnose and treat hearing problems earlier, the introduction of routine hearing tests (“hearing screening”) for all newborns is currently being discussed in Germany. Hearing tests are not carried out routinely in all children everywhere.

Screening programs could be introduced at other ages, but the one time when all infants are accessible for screening is shortly after birth when they are still in hospital. Screening the week after birth has the advantage that nearly all newborns are included, but it means that children who develop hearing problems later are not covered.

There are several painless tests that can be used to test a

baby’s hearing. These include the “otoacoustic emissions” test (OAE) which measures echoes in the ear, and so-called brainstem tests, which measure electrical responses from the hearing nerves and brain. Pilot screening programs are currently being carried out in some parts of Germany.

Studying the outcomes of hearing screening programs for newborn babies

Together with researchers from England and the German Cochrane Centre, researchers at the German Institute for Quality and Efficiency in Health Care (IQWiG) studied the possible effects of routine hearing screening for all newborns. They particularly wanted to know whether it was possible to estimate how many more babies with hearing impairment would be detected with routine screening, and whether earlier intervention is more effective in the short or longer term. What interested them the most was whether the screening and any resulting treatments have a direct impact on the child’s development, education and quality of life.

To determine whether or not screening for babies with congenital hearing loss could be valuable, the consequences of an earlier diagnosis are important. Screening would make sense if it turns out that early intervention is beneficial for the child. However, if earlier intervention makes no difference, or it actually has particular risks, then screening would not be worthwhile.

Whether a screening program is successful also depends fundamentally on how reliable the test results are. For instance, how often the test result is a “false positive” (when the test mistakenly diagnoses hearing deficits) or a “false negative” (when the test mistakenly determines that hearing is normal). Such incorrect results can lead to unnecessary anxiety and over-treatment – or in the case of a “false negative”, possibly to delayed diagnosis and treatment because of a false sense of security.

Research on screening and early intervention

The researchers did a thorough and extensive search for relevant studies. The best kind of study would be where researchers were able to follow the development of two groups of children – one group which had been screened, and one group which had not – for a long time, so that their outcomes could be compared. This could be done in a trial that divides the children into “screening” and “no screening” groups. It could also be done with studies

which compare what happens to children in one area where screening has been introduced, with the children in another area where there is no screening. Another option is to study the same area, but at different points of time: comparing a group of children who were born before the screening was introduced, with a similar group of children who were born later and screened.

The group of researchers found 2 relevant studies which compared outcomes for children who lived in different areas or were born at different times. One was done in England and the other in the U.S. Another 4 studies compared the results of early treatment for a diagnosed hearing impairment with later treatment. In addition, 9 studies on the reliability of the most common tests were included. However, the quality of many of these studies was not good enough to get very definite answers and good estimates of what could be expected from routine screening.

The accuracy of the OAE hearing test in newborn babies

There were 9 studies that looked at the reliability of hearing test results in newborn babies. They were done in North America, China and Europe (including in Germany). All but one of the studies was done in a general group of babies, not just babies who were at high risk of having hearing impairment. The studies all involved testing with OAE. In 8 of the studies, the goal was to see how accurately OAE could diagnose hearing problems. The comparison test was a brainstem test.

In one study, though, the testing was part of a study of routine hearing screening. In other words, there was a two-step approach. The OAE was used as the screening test to identify babies who might have hearing problems. If the OAE test indicated that a baby might have hearing problems, a brainstem test was done on the same day. More thorough diagnostic tests were then done at a later time.

In these 9 studies, the OAE had a sensitivity rate of about 70%. This means that the OAE was able to find about 70% of the babies who had hearing impairments. But for every 100 babies tested, 30 babies with hearing impairment were not diagnosed by the test at first. The results were better in the two-step screening program: that program found 92 out of every 100 babies that had a hearing impairment. However, this is only a very rough estimate of the accuracy of the test. More rigorous trials are needed to know for certain how reliable this test is.

Although the sensitivity of the two-step test was not very high, this strategy had a fairly high specificity rate. The specificity rate tells you how likely it is that a child who does not have impaired hearing will also have test results that show this. In this case, the specificity rate was 98.5%. In other words, there were relatively few “false positive” test results. At most, two of every 100 babies who had normal hearing were incorrectly diagnosed as having a hearing impairment at first. Follow-up tests help to identify which babies have had false positives. In these studies, babies were considered to have a hearing impairment if they had a moderate or severe hearing loss of 40 decibels or more.

The results of screening programs and early intervention

There were only 2 studies of screening programs, and neither of them were randomized controlled trials. This is the type of trial which could have provided the most certainty about the effects of screening programs. There were 4 studies comparing early treatment with later treatment. Together, these suggest that early diagnosis and screening might be beneficial for children with congenital hearing loss.

One of the screening programs was in the U.S. and one was in England. The studies (and programs) were very different. The research showed that screening newborns does mean that hearing impairment is usually diagnosed much earlier than if there is no routine screening. In the English study, among the children who had not been screened after birth, only 3 out of every 10 children with a hearing impairment (27%) were diagnosed in their first nine months of life. By comparison, among children in the screening group, the hearing impairment was diagnosed in 7 out of 10 children (67%) before nine months. In other words, the early hearing screening was able to detect the hearing impairment early in an extra 4 out of every 10 affected children.

The final question then is whether or not early diagnosis makes an important difference. The research found that children whose hearing impairment is diagnosed through such screening have better early language development than do children whose hearing impairment is diagnosed later. This was confirmed by the four studies in which children who were treated early were compared with children who were treated later. Different treatments were examined, in particular special education or the use of hearing aids. How newborn hearing screening affects other important areas of the child’s life, such as

development at school, psychological wellbeing and quality of life, has not been studied enough so far.

Pilot projects in some regions of Germany showed that early diagnosis was well accepted: very few parents refused the test when it was available. There is not enough good information on whether or not the screening program affected the parents' level of anxiety.

The researchers at IQWiG came to this conclusion: routine hearing screening for newborns can improve the chances that a child with congenital hearing loss may be diagnosed and treated earlier than without such a screening program. This can improve early language development in children who have hearing problems. However, we cannot know for certain what effects this has on the children because there have not been enough good studies on the impact of early diagnosis and early treatment for hearing impairment in babies. If programs like this are introduced, the researchers at IQWiG recommend that they be designed in such a way that their quality and the effects on the children can be measured reliably.

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Note

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Glossary

screening

Screening is a systematic approach to trying to find illnesses among people who do not have symptoms or other obvious signs of disease. An example is screening for breast cancer with mammography.

infection

In medicine, we speak of an infection when a person has caught a germ (an infectious agent). This germ can be a bacterium, a virus, a fungus or a worm. The germ multiplies and then either spreads throughout the body or only attacks one particular organ. As long as there are no signs of a disease, this is called an asymptomatic infection. When the body shows a reaction to the germ in the form of symptoms, this is called a symptomatic infection (an infectious disease). The period between the moment the germs enter the body and the moment the first symptoms of the disease appear, is called the incubation period. It may last a few hours or days, or even many years. An infection does not necessarily have to lead to the onset of a disease.

diagnosis

The term diagnosis (from the Greek word *diagnosi*: "distinguishing") is used to mean the identification and naming of an illness or a disease. A diagnosis is usually made by evaluating the medical history, symptoms and test results. The tests include both comprehensive physical examination and blood tests or examinations using medical instruments such as ultrasound or x-ray.

Sources

Institute for Quality and Efficiency in Health Care (IQWiG). *Neonatal screening for early detection of hearing impairment. Final report S05-01 Version 1.0*. Cologne: IQWiG. February 2007. [Executive summary (URL: http://www.iqwig.de/download/S05-01_Executive_Summary_Neonatal_screening_for_early_detection_of_hearing_impairment_neu.h)] [Full text (URL: http://www.iqwig.de/download/S05-01_Final_report_Neonatal_screening_for_early_detection_of_hearing_impairment.html)]

The German Institute for Quality and Efficiency in Health Care (IQWiG)

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Evidence basis of our health information

Our information is based primarily on systematic reviews of the effects of health care. Systematic reviews are necessary to gain an objective picture of health care. In order to do this, a clear question is formulated. Researchers then find all the relevant studies that could answer this question. They then evaluate those studies.

You can find a list of the evidence and other scientific literature on which this information is based at www.informedhealthonline.org

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