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Ear Diseases Diagnosis Expert System Using SL5 Object

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Abstract

Hearing is considered the most important sense of the five senses, as the sense of hearing human life depends on in all that play and practiced. It is through hearing, human learn speech, languages skills, communication skills and communicate with others. For a patient to recover from any illness or weakness that affects the sense of hearing, he/she requires an accurate diagnosis of his/her the situation. In this paper will present an expert system that quickly diagnosis patient's condition and propose a suitable solution for the problem. This expert system is designed and implemented in SL5 Object language. This expert system was tested by a group of physician and found to be a useful tool that aids physicians and patients suffering from hearing senses problems.

Keywords: Expert Systems, Knowledge, SL5 Object, Ear Diseases, Diagnosis

Introduction

There is no doubt that the sense of hearing is one of the most important of the five senses that we are blessed with, as the hearing of reliable human in his life all that played and practiced, it is during the hearing a human learn speech and language, learn language skills and communication skills and communicate with others. Hearing helps human to know the sounds by analyzing then and alarm him/her at risk. This sense depends on the person's ability to sense vibrations and acoustic oscillations through the hearing organ in the body, namely the ear, where they pass through these oscillations and vibrations ear "hearing aid" to reach the brain that analyzes sounds and understand them[1,2].

Some people may get into hearing trouble, a so-called scientifically as "noise pollution", which is the result of either a weakness in the sense of hearing, or as a result of weakness in the focus, or injury to other high blood pressure, as well as a result of nervous tension, and is measured as the proportion of hearing of the individual through a "equ Lemaitre," a device that test audio electrically, provide examiner ratios and accurate measurements of the ratio of the hearing person[2].

For those who suffer from the weakness of the problems in the sense of hearing, it is during the last century and the years have been a lot of acoustic audio devices that help the hearing impaired to improve their hearing development through medical speakers and the development of many technologies in this area, or through the cochlear implant operations. It helps to be an alternative in some cases to the original device cochlea in the ear device in the human body in the case of the defect in the hearing as a result of an imbalance in the work of the cochlea itself [3].

Expert Systems

Expert Systems is a branch of the strongest branches of artificial intelligence, which turned to be the most important branch of computer science. Software based on tradition of a human expert behavior in a particular field, by extracting, compiling, analyzing and re-using of information and experience of the human expert in the field and annexed in a system called expert system. So that these systems can address the problems in this area, rather than the people with the expertise and assistance in the transfer of these experiences to other people[8].

This smart program takes the rules learned from human experience and use them in the form of the "IF conditions Then results" methods of derivation and reasoning to extract and conclude results, and the resulting match of these conditions with the condition or the facts of what is specific to the problem, which is intended to find a solution[9].

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The design of expert systems vary depending on programmers based design, according to the purpose of its creation, however, there are broad lines of the existing terms of components systems agree that the expert system consists of three main parts namely[10]:

- Knowledge Base.

Where the reasoning property alone is not enough to give the computer recipe of intelligence, man Intelligence is capable of reasoning and deducting of his extensive background information, so was the knowledge base is an important part of the expert system, and knowledge can be represented in expert systems in different ways but the most common one is production rules. Here we must not confuse the data and rules of knowledge in an expert system, as the first step is to retrieve stored information while the expert system is thinking and second to use the laws of logic to reach the final results.

- Inference Engine

Inference Engine machine determines when and how to use the facts or rules in the knowledge base. It specifies which rule will be fired and determine whether the solution of the problem is reached or not. It can use knowledge bases of different expert systems.

- User Interface

Through user interface, end user can communicate with the expert system, and enables the user to answer questions and inquiries about the problem easily. Thus the expert system provide solutions and recommendations to the user in a clear and complete way.

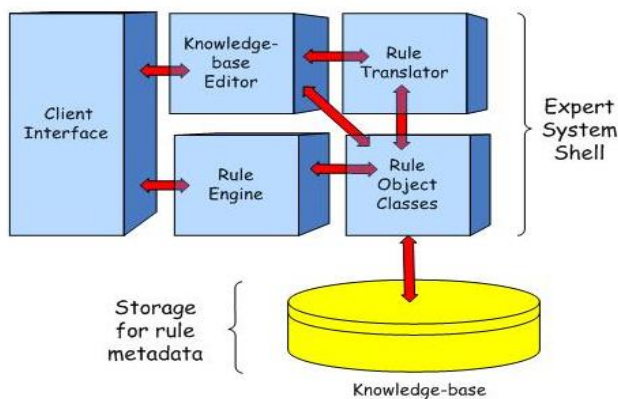


Fig 1: Expert system architecture

To create an expert system: Three important things must be provided:

- The Knowledge Engineer who analyzes the problem and write the expert system,
- A human expert who is a specialist in a particular area.
- An expert system language this is suitable for encoding the knowledge collected from the human expert.

Some of the advantages of expert systems are: give steady answers for repetitive decisions, processes and tasks, grasp and keep significant level of knowledge, Ease of use, always remember to ask a question, as a human might not, can work all the time without getting tired, can be used by the user any time.

Background/ Literature Review

There are no researches have published scientific papers for an expert system which diagnoses ear problems, but there are some scientific papers which dealt with expert systems that address some other diseases such as skin problems, endocrine, eye problems, low back problems, mouth problems, neck problems[6,15-24].

Materials and Methods

This expert system make the diagnosis of diseases of the ear on the human life stages beginning with newly born to the elderly by asking the end user questions that requires True or False answer.

The proposed expert system will ask the user to choose the correct answer in each screen. At the end of the expert system session, the diagnostics expert provide the user with identification of the problem, as well as provides him/her the advice or the recommendation for dealing with the problem.

Figure 2 show the opening screen of the expert system, Figure 3. Shows a sample of questions asked by the expert system, and Figure 4 shows the diagnosis of the ear problem and the recommendation of how to deal with the problem.

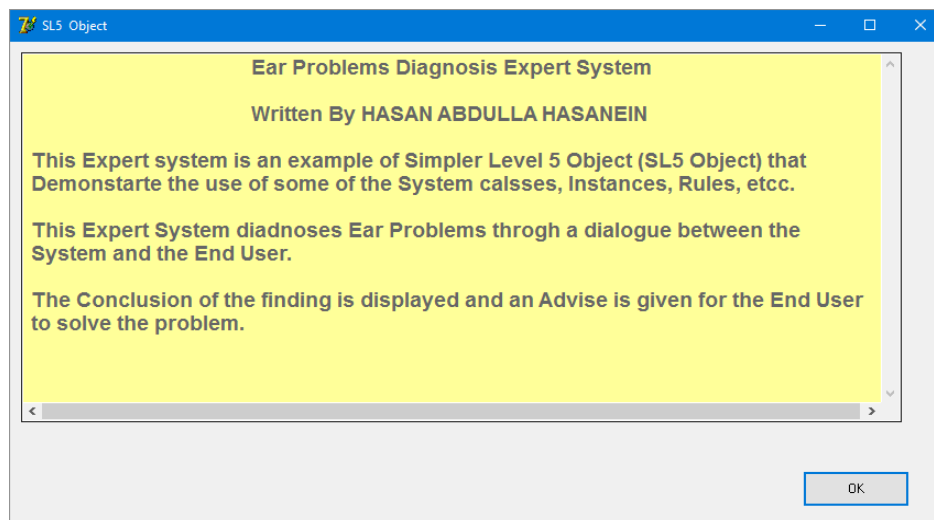


Fig 2: Opening screen of the expert System

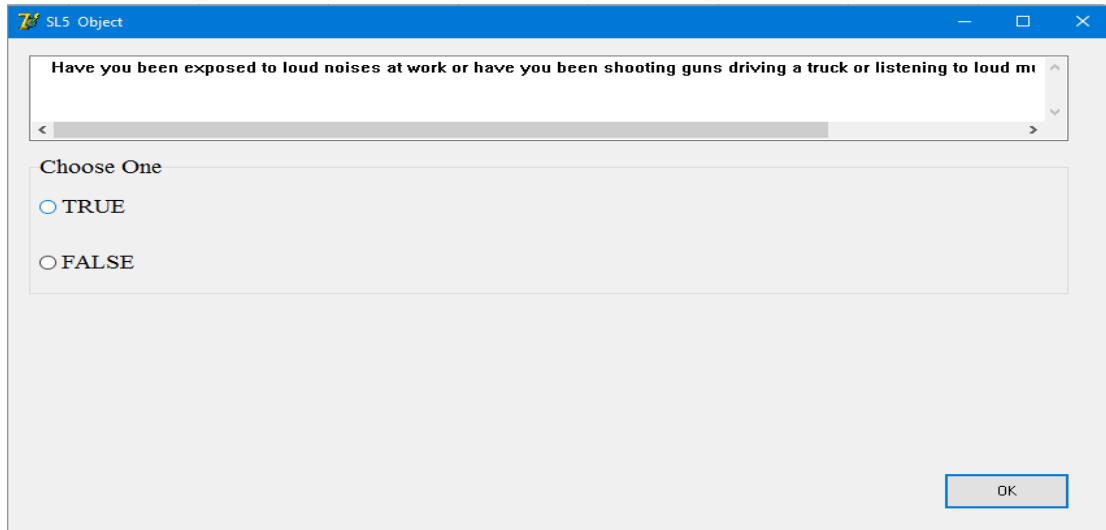


Fig 3: One type of question Asked by the expert System

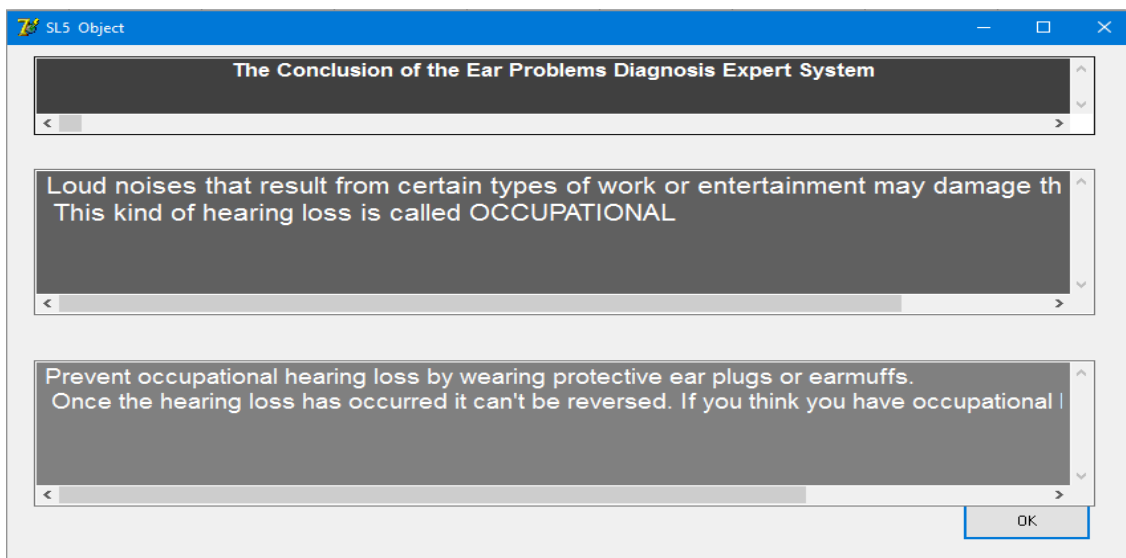


Fig 4: The Conclusion of the expert system

The captured knowledge from the human expert and specialized websites are converted into SL5 Object syntax (Objects, Rules, and Facts)[12].

Currently our expert system provide coverage for the following ear problems[1-5,13-14]:

Occupational hearing loss

Occupational Noise-induced hearing loss (NIHL), acoustic trauma, hearing loss, which is a task of a constant or intermittent noise contact extent, which typically increases

slowly over quite a few years. This is in disparity to professional acoustic shock, which is described by a swift revolutionize in the hearing as a result of one time exposure to a sudden disintegrate of sound, like a bomb explosion. Diagnosis is done by the doctor NIHL OEM, first by considering the history of noise exposure. Most frequently this type of noise causes the destruction of inner ear and this is what is recognized as occupational hearing loss. See Figure 5 for detail.

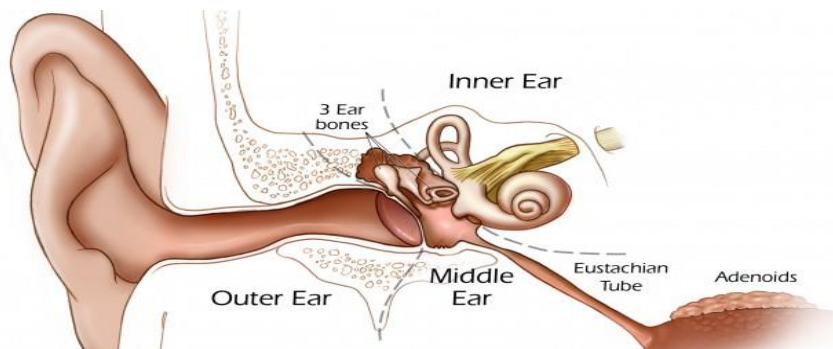


Fig 5: Occupational Noise-induced hearing loss

Ceruminosis

Ceruminosis is a stumbling block in one or both ears and this stumbling block resulting from the concentration of

material in the ear wax in big quantities and this growth leads to loss of hearing, and can be processed for consent to carry out cleanup method[3].

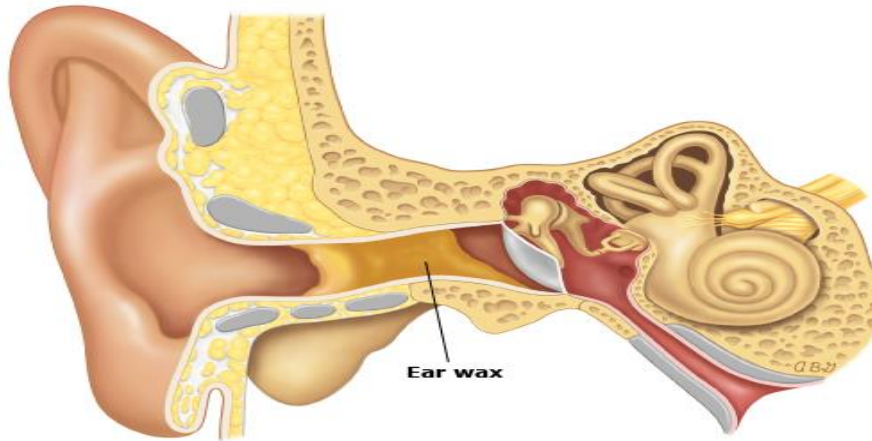


Fig 6: Show a big amount of wax in the ear

Presbycusis

Presbycusis is one of the health problems that bother the ear, which is the hearing loss totally, or in part, can be as a consequence from the accumulated turbulence that occurred to a patient throughout the period of his life as a result of old age and can cause atrophy capillaries auditory nerve or harm to one audio members and can be completely

no cure It can be partly as beforehand mentioned any advantage in the loss of capability to hear only distant voices or sounds too low and may influence both ears, or one of them is classified according to the stage, a disorder to a serious, medium and simple, this is calculated and calibrated according to the height of sounds heard by the patient.

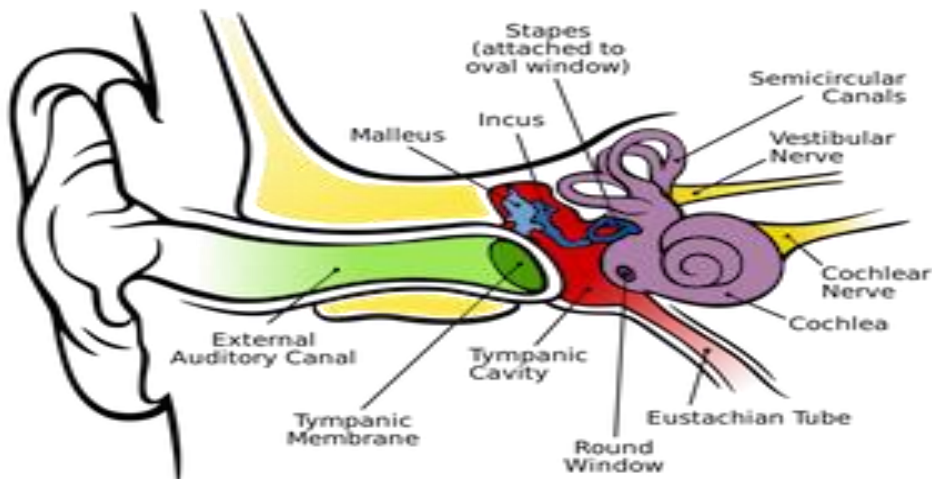


Fig 7: Presbycusis is usually caused by damage to the inner ear, shown here in purple.

Signs and symptoms of senile deafness designed senile(Presbycusis)

The signs and symptoms of this disease appear as follows: hearing loss is gradual or total, tinnitus, vertigo, occurrence of pressure on, the ears and sometimes feeling pain, failure to hear other conversations, failure to hear the distant sounds, feeling sounds very high, although it is not so, do not listen to the voice of the female from time to time and hear the male voice better.

In the case of a patient loses focus noise in hearing other voices: failure to use the phone, hear the TV on loud always.

Designed treat of senile designed senile of the disease followed remedial actions: the treatment of the fundamental causes that he knew the way for the re-hearing of the injured.

Various of the measures that enhance the patient's sensitive hearing, including: Installation reputations magnifying sound can assist the patient to survive with this disorder. Occasionally doctors can remedy to a surgical procedure. Cochlear implantation in a few medical cases can be the perfect solution for the handling of deafness.

Tumors of the middle ear

Tumors of the middle ear can produce some other tumors is natural in central and neighboring tissues for instance ear temporal bone of the skull which are not well-known than its antecedent. The majority of the middle ear tumors are kindly non-cancerous come in have some cancerous malignant ability to spread to other parts of the body such as cancer squamous cells. Benign tumors develop gradually, typically while malignant ones are fast-growing.

Feeling embolism in the pretentious ear can point to, in addition to hearing loss or tinnitus (voice such as ringing or pinging or growls in the ears) and ear secretions and facial paralysis, giddiness and unevenness to the presence of a tumor. One must visit a doctor when feeling any of these symptoms. It helps CT scan or magnetic resonance imaging to decide the existence of the tumor. The doctor can acquire in this case a tissue sample of the tumor to decide its quality (benign or malignant).

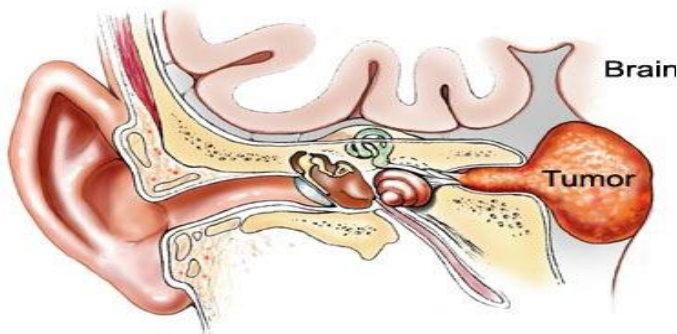


Fig 7: Tumors of the middle ear[5]

Ear Resin

Recurring middle ear infections may cause ear resin (otitis media with effusion), where the viscous fluid is increasing and may affect children hearing. This can guide to talk in a manner that is clear or behavioral problems. If the mother is a smoker, it boost the proportion of children injured by the disease.

Conclusion and Future Work

All doctors agree that the most important step in treating the disease is the accurate diagnosis of the disease. In this paper we presented an expert system for accurate diagnose of some of the ear problems through a series of questions and then the expert system gives the user the final diagnosis and instructions to deal with the illness. This expert system was designed and implemented using Simpler Level Five Object expert system language. This expert system for ear problems was tested by a group of physician and found to be a useful tool that supports physicians and patients suffer from hearing senses problems. In the near future, we will add more knowledge to the expert system so it can cover more diseases of the ear problems.

Expert System SL5 Source Code

!
 ATTRIBUTE start SIMPLE
 ATTRIBUTE Have you been exposed to loud noises at work or have you been shooting guns driving a truck or listening to loud music for long periods of time SIMPLE
 ATTRIBUTE Are you experiencing partial hearing loss along with earache and a feeling of fullness in the ear SIMPLE
 ATTRIBUTE Has your hearing loss occurred gradually as you have aged SIMPLE
 ATTRIBUTE Are you experiencing gradual hearing loss in one ear only SIMPLE
 ATTRIBUTE Do you have bouts of dizziness nausea or vomiting ringing in one ear and hearing loss in the same ear SIMPLE

ATTRIBUTE Are you taking any medicines SIMPLE
 ATTRIBUTE Do you have pain reduced hearing fever cold symptoms or a fluid sensation in your ear SIMPLE

INSTANCE the domain ISA domain
 WITH start := TRUE

INSTANCE the application ISA application
 WITH title display := introduction
 WITH conclusion display := Conc
 WITH numeric precision := 8
 WITH simple query text := "
 *?
 is

* "
 WITH numeric query text := "What is the value of :
 *
 of
 *"
 WITH string query text := "What is(are):
 *
 of
 *"
 WITH time query text := "What is(are):
 *
 of
 *"

INSTANCE introduction ISA display
 WITH wait := TRUE
 WITH delay changes := FALSE
 WITH items [1] := textbox 1

INSTANCE textbox 1 ISA textbox
 WITH location := 10,10,800,350
 WITH pen color := 102,102,102
 WITH fill color := 255,255,153
 WITH justify IS left
 WITH font := "Arial"
 WITH font style IS bold
 WITH font size := 14
 WITH text :="

System Ear Problems Diagnosis Expert

Written By HASAN ABDULLA HASANEIN

This Expert system is an example of Simpler Level 5 Object (SL5 Object) that Demonstrate the use of some of the System classes, Instances, Rules, etc.

This Expert System diagnoses Ear Problems through a dialogue between the System and the End User.

The Conclusion of the finding is displayed and an Advise is given for the End User to solve the problem."

INSTANCE Conc ISA display
 WITH wait := TRUE
 WITH delay changes := FALSE

WITH items [1] := title textbox
WITH items [2] := problem textbox
WITH items [3] := advise textbox

INSTANCE title textbox ISA textbox
WITH location := 20,10,800,70
WITH pen color := 255,255,255
WITH fill color := 64,64,64
WITH justify IS center
WITH font := "Arial"
WITH font style IS bold
WITH font size := 13
WITH text := " The Conclusion of the Ear Problems
Diagnosis Expert System"

INSTANCE problem textbox ISA textbox
WITH location := 20,110,800,130
WITH pen color := 255,255,255
WITH fill color := 96,96,96
WITH justify IS left
WITH font := "Arial"
WITH font size := 16
WITH text := " "

INSTANCE advise textbox ISA textbox
WITH location := 20,280,800,130
WITH pen color := 255,255,255
WITH fill color := 128,128,128
WITH justify IS left
WITH font := "Arial"
WITH font size := 14
WITH text := " "

RULE R0
IF start
THEN ASK Have you been exposed to loud noises at work or have you been shooting guns driving a truck or listening to loud music for long periods of time

RULE R1
IF Have you been exposed to loud noises at work or have you been shooting guns driving a truck or listening to loud music for long periods of time
THEN text OF problem textbox := "Loud noises that result from certain types of work or entertainment may damage the inner ear.
This kind of hearing loss is called OCCUPATIONAL"
AND text OF advise textbox := "Prevent occupational hearing loss by wearing protective ear plugs or earmuffs.
Once the hearing loss has occurred it can't be reversed. If you think you have occupational hearing loss, see your doctor "
AND exit OF the application := TRUE
ELSE ASK Are you experiencing partial hearing loss along with earache and a feeling of fullness in the ear

RULE R2
IF Are you experiencing partial hearing loss along with earache and a feeling of fullness in the ear
THEN text OF problem textbox := "Earwax blockage, called CERUMINOSIS, can cause hearing loss in one or both ears"
AND text OF advise textbox := "Use mineral oil, baby oil or an over-the-counter earwax removal kit to soften the

wax in your ear.
If wax still can't be removed, see your doctor "
AND exit OF the application := TRUE
ELSE ASK Has your hearing loss occurred gradually as you have aged

RULE R3
IF Has your hearing loss occurred gradually as you have aged
THEN text OF problem textbox := "You may have PRESBYCUSIS, hearing loss related to aging and other factors"
AND text OF advise textbox := "See your doctor for an ear exam and a hearing test. You may benefit from a hearing aid"
AND exit OF the application := TRUE
ELSE ASK Are you experiencing gradual hearing loss in one ear only

RULE R4
IF Are you experiencing gradual hearing loss in one ear only
THEN text OF problem textbox := "You may have an ACOUSTIC NEUROMA, a noncancerous tumor on the hearing nerve"
AND text OF advise textbox := "See your doctor"
AND exit OF the application := TRUE
ELSE ASK Do you have bouts of dizziness nausea or vomiting ringing in one ear and hearing loss in the same ear

RULE R5
IF Do you have bouts of dizziness nausea or vomiting ringing in one ear and hearing loss in the same ear
THEN text OF problem textbox := "You may have MENIERE'S DISEASE or a more serious TUMOR on the hearing nerve"
AND text OF advise textbox := "See your doctor"
AND exit OF the application := TRUE
ELSE ASK Are you taking any medicines

RULE R6
IF Are you taking any medicines
THEN text OF problem textbox := "Certain medicines can cause hearing problems such as ringing in the ears"
AND text OF advise textbox := "See your doctor"
AND exit OF the application := TRUE
ELSE ASK Do you have pain reduced hearing fever cold symptoms or a fluid sensation in your ear

RULE R7
IF Do you have pain reduced hearing fever cold symptoms or a fluid sensation in your ear
THEN text OF problem textbox := "This may be due to a cold, flu, allergies or a more chronic condition, SEROUS OTITIS MEDIA, in which fluid builds up in the middle ear"
AND text OF advise textbox := "Use cold medicine for 5 to 7 days. If you don't feel better or if you have a constant fever or severe pain, see your doctor"
ELSE text OF problem textbox := "For more information, please talk to your doctor.
If you think your problem is serious, call your doctor right away."
AND text OF advise textbox := " "
END

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