

A CORRELATION ANALYZER FOR VESTIBULAR DISORDERS

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ABSTRACT

The vestibular system is the sensory apparatus of the inner ear that helps the body maintain its postural equilibrium. The information furnished by the vestibular system is also essential for coordinating the position of the head and the movement of the eyes. The vestibular system includes the parts of the inner ear and brain that process the sensory information involved with controlling balance and eye movements. If disease or injury damages these processing areas, vestibular disorders can result. Vestibular disorders can also result from or be worsened by genetic or environmental conditions, or occur for unknown reasons.

The severity of the problem can be identified with the knowledge based system that intern uses domain specific knowledge leads to develop an Expert system. This expert system will analyses the details of the patient through the software based questionnaire and checks the severity of the problem and suggests suitable cognitive and behavioral therapies to mitigate the problem of vertigo. The expert system also suggests suitable rehabilitation exercises and diet in considering usage, duration, precautions based on the case and the severity and develops a comprehensive response, which can be used as supplement to the doctor.

Keywords— Positional Vertigo, dizziness, inflammation, cognitive therapy, expert system.

I. INTRODUCTION

The expert systems are developed to assist the experts in making decisions for domain specific problems. The major components of an expert system are knowledge base and the inference engine. The inference engine uses the domain knowledge that was already fed to the system as knowledge base and controls the questionnaire depending on the age group and gives the conclusion that specifies further treatment to be given. The proposed expert system is a rule based expert system that uses “if<antecedent> then<consequent>” rules to work out with the answer given to the questionnaire. This clinical expert system for vertigo disorders concentrates mainly on 3 age groups. They are 1.Adults, 2.Middle aged and 3.Aged people. The person falls under the age group 21-45 is treated as adults and the age between 45 and 60 then it is treated as middle aged group and above 60 is treated as Senior citizen’s group or aged group. There will be different sequence of questions for different age groups. Depending upon the age group separate questionnaire is prepared. So the proposed system will estimate the problem with the help of these questions and the problem severity will be estimated. Depending on the data provided the systems will generate a comprehensive report stating the severity of the problem. The severe cases will be sent to the respective doctors for the further diagnosis. This information of the doctors can be seen in the links of expert system. The cases with moderate severity will be suggested with the needed cognitive and behavioral therapies and if the problem is not solved then cases will sent to the doctors. The mild cases are also suggested with the rehabilitation exercises and diet control. The videos that help in daily exercises can be seen in the system.

II. RELATED WORK

SYMPTOMS OF POSITIONAL VERTIGO

The symptoms of positional vertigo include the following. They are sudden dizziness that lasts less than a minute, Feeling of spinning, Dizziness with certain movements, Loss of balance, Nausea, Vomiting, Feeling unsteady, Fatigue, Swaying. The symptoms may last for one minute or two minutes and they may last for weeks, months and even for years in rarest of the rare cases

CAUSES OF POSITIONAL VERTIGO

The inner ear contains tiny crystals. These crystals can sense movement and help you keep your balance. BPPV occurs because of a shift in location of these crystals. When these crystals move to the wrong location or clump in one spot, BPPV can result.

BPPV may be caused by:

- Head injury,
- Viral infection, such as Labyrinthitis (infection of the nerve to the ear),
- Disorders of the inner ear,
- Prolonged immobility of the head,
- Age-related changes to inner ear

TESTS FOR POSITIONAL VERTIGO

To diagnose benign positional vertigo, the health care provider will often perform a test called the Dix-Hallpike maneuver. The doctor holds your head in a certain position and asks you to lie quickly backward over a table. As you do this, the doctor will look for abnormal eye movements and ask if you feel a spinning sensation. The doctor may use various methods to help evaluate your eye movements. A physical exam is otherwise normal. A complete medical history and careful neurological exam should be done to rule out other reasons for your symptoms. Tests that may be done include EEG, Electronystagmography, Head CT, Head MRI, Magnetic resonance angiography of the head, Warming and cooling the inner ear with water (caloric stimulation) or air to test eye movements.

DIET RECOMMENDATIONS FOR POSITIONAL VERTIGO

FOODS TO AVOID

Foods high in sodium, such as lunch meats, canned soups, frozen foods and other processed foods have high sodium content and can therefore be dehydrating, according to the Mayo Clinic. If you are curious as to how much sodium intake is appropriate for you, you should consult a dietitian or physician to determine an appropriate level. You should also avoid foods known to trigger migraines, as these contain high levels of tyramine, which can cause dizziness. These foods and drinks include red wine, chicken livers, smoked meats, chocolate, citrus fruits, Brie, cheddar cheese and nuts

FOODS TO CHOOSE

Instead of foods high in sugar, choose those high in complex sugar, such as whole-grain breads and legumes. Also, you should try the following to lower your salt intake while cooking by substituting salt-free seasonings or low-sodium vinegar, lemon juice or herbs. Choose fresh fruits and vegetables instead of canned whenever possible, Avoid processed foods or choose those with less than 35 mg sodium per serving. Opt for reduced-salt or reduced-sodium versions of products you enjoy whenever possible. As a general rule, consume 2,000 mg or less of sodium per day, according to the American Academy of Family Physicians.

REMEDIAL THERAPIES

The positional vertigo disorders are sometimes treated in wait-and-see manner because it will be cured on its own. However there are some therapies that help in mitigating the positional vertigo disorders. They are Epley maneuver and the Brandt-Daroff exercise.

EPLEY MANEUVER EXERCISE

This maneuvers involve a series of specifically patterned head and trunk movements performed by a trained professional who closely watches eye movements with each position change. This maneuver can be performed in the doctor's office with medication such as diazepam to help block nausea during the procedure, which takes about 15 minutes to accomplish. Precautions are provided for the days immediately following the procedure in order to ensure that the canaliths don't have the opportunity to return to their formerly problematic location in one of the semi-circular canals.

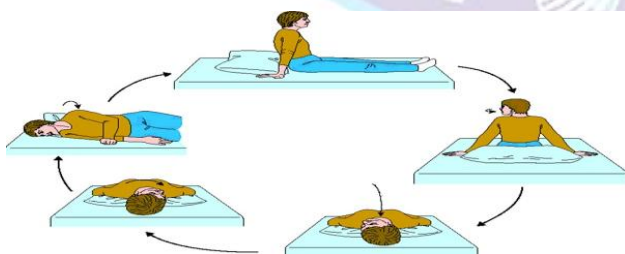


Fig: Steps involved in the epley maneuver exercise

BRANDT-DAROFF EXERCISE.

These exercises are designed to break up this material and unblock the canal. Sitting on the edge of a bed and turning head slightly to the left (approximately 45 degrees). While maintaining this head position, lie down quickly on right side so that the back of your head is resting on the bed. Wait for 20 to 30 seconds or for any giddiness to resolve. Sit up straight, and again wait for 20 to 30 seconds or for any giddiness to resolve. Turn the head slightly to the right and repeat the sequence in the opposite direction. Continue this process for 10 minutes (5 or more repetitions to each side). Perform the exercises 3 times daily if possible.

The symptoms of giddiness need to be reproduced by the exercises if any benefit is to occur. If the exercises are done regularly, the symptoms should resolve over a period of several days in most cases.

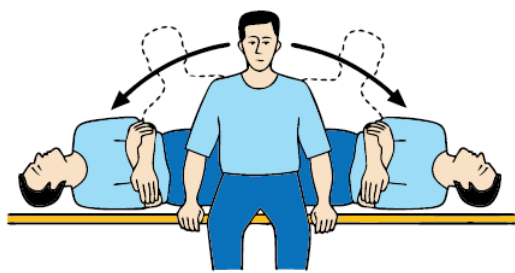


Fig: Steps involved in the brandt daroff exercise

III.OBJECTIVES OF THE PROPOSED SYSTEM

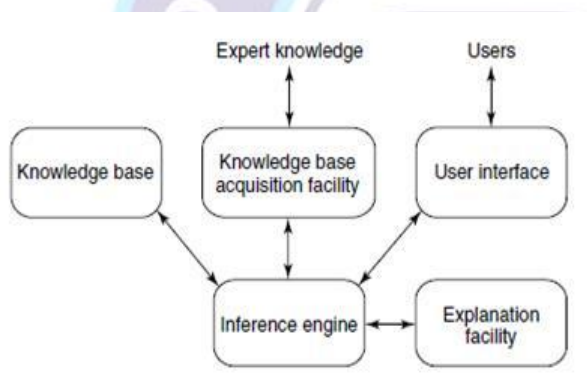
The proposed clinical expert system is to fulfill the following objectives.

- To develop an expert system with domain specific knowledge that interacts with the users.
- To collect and to create, maintain the medical records of the patient's consulted.
- To estimate the severity of the problem based on the symptoms expressed.
- To give the relevant data and information of doctors for particular solutions for the vertigo disorders,
- To assist doctors in various symptoms and providing information that helps the doctor to make a decision concerning a patient's health.
- To suggest various cognitive, behavioral therapies and rehabilitation exercises.

WORKING OF THE PROPOSED SYSTEM

The proposed clinical expert system works with the help of domain specific knowledge which is used in the process of analyzing the severity of the problem. The system which is interactive in nature first collects the data with the help of software based questionnaire which contains both the personal data and the information about the problem and the symptoms. The collected data will be analyzed with help of knowledge fed to the system and generates a comprehensive report that specifies the severity of the problem as well as the suitable therapies that are helpful in solving the problem. The report also contains the rehabilitation exercises that help to mitigate the problem. The data that was collected from the patients will be saved and maintained in the database for the further investigation of the clinical treatment of the patient.

ARCHITECTURE OF AN EXPERT SYSTEM



The purpose of the inference engine is to seek information and relationships from the knowledge base and to provide answers, predictions, and suggestions in the way a human expert would. The inference engine must find the right facts, interpretations, and rules and assemble them correctly. Two types of inference methods are commonly used – Backward chaining is the process of starting with conclusions and working backward to the supporting facts. Forward chaining starts with the facts and works forward to the conclusions. The explanation facility allows a user to understand how the expert system arrived at certain results. The overall purpose of the knowledge acquisition facility is to provide a convenient and efficient means for capturing and storing all components of the knowledge base. Very often specialized user interface software is used for designing, updating, and using expert

systems. The purpose of the user interface is to ease use of the expert system for developers, users, and administrators.

THE STAKEHOLDERS

The expert systems are developed mainly for four different groups of users. They are 1. Clinicians, 2. Medical researchers, 3. Patients and 4. Administrators. Clinicians could include physicians (including junior physicians) and nurses to use their knowledge and expert systems to make decisions on behalf of others by, for example, diagnosing diseases or evaluating drug interactions from a treatment or adopting a nursing strategy to alleviate pain. General research has shown that expert physicians do make use of explanation facilities, but their requirements are very different to that of other users. Experts tend to use feedback rule-trace explanations and are more likely—than no experts—to use explanations for resolving anomalies, such as disagreements with system advice, exploring alternative diagnoses, and verification of assumptions. However, no experts such as trainee physicians are more likely to use arrange of explanations types for short- and long-term learning. Administrators do not have direct clinical interaction with patients but are responsible for the management of health care options and facilities. They may therefore use expert systems to manage health care options and could benefit from explanation facilities by aiding clinicians, through, for example, the managing of patient referrals by finding out whether a patient is suitable for a referral. All of the explanation types discussed previously may benefit administrators depending on the nature of the application task. Furthermore, administrators may use expert system for patient care.

IV. CONCLUSION

The vertigo disorders are very common in aged people. But in the case of adults it is very rare and if it arises it can be mitigated through some simple exercises and some cognitive, behavioral therapies. This system helps in estimating the severity of the problem and also suggests the needed clinical aid to mitigate the problem. The expert system gives the list of doctors who treats for these types of disorders. This expert system also suggests suitable therapies and exercises.

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