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Application Design to Diagnosis of Bone Fracture (Traditional) using Forward Chaining Methods

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Abstract *-- **In this expert system will be created an expert system that will be used to diagnose diseases of bone fractures in humans using forward chaining and it is an application designed with engineering reasoning and tracking forward the start of a set of facts (data) to look for rules (indications) were matched with allegations / hypothesis that there towards the conclusion. An expert system developed web-based technology client and PHP (Hypertext Proprocessor) and MySQL based on the server side. The expert system is designed by using the method of Forward Chaining wherein expert system will display the questions in the form of indications that are often experienced by the user who will mengarkan user to reach conclusions and treatment that may be experienced by user (patient).***

Keywords: Expert system, Bone Fractures, Expert system, Forward Chaining, Web

I. INTRODUCTION

The bones are the framework of the body that causes the body to be able to stand up straight, place of attachment of muscles thus allowing the course of the blood vessels, where the bone marrow and nerve protect the soft tissues, and bone is also an organ that humans need to lift and carry heavy goods. The Bone is an organ that we need to perform daily activities, so we can not imagine how disruption when there is a damage that happens to our bones. Some people think the bone is dead tissue that is passive, when in fact not. Bone is a living tissue and grow, as well as the constantly unload, reshape and improve its network.

Bone Fracture is a condition that damages the frame and makes the bones weak and prone to fracture. Weak bones are not a natural part of aging. While strong bones begin in childhood, people of all ages can improve their bone health. Difficulties in diagnosing fractures, the authors make the application of expert systems to diagnose broken bones in humans by using forward chaining method which sourced from an expert who is in the Broken Bones Medical Clinic, the expected ability of an expert who specializes in health issues, particularly regarding diseases of the bones (in this case is an expert fractures) can be substituted into the computer in the form of a program that can be used by many people and can be used to resolve problems experienced independently without the presence of an expert directly so that we can conclude the diagnosis.

1.2 RESEARCH PROBLEMS

Based on the background described above by author, here is the research problems:

1) *How to design and build an expert system to help determine the types of broken bones, based on the results of questions about indications and bone fractures?*
2) *How to implement a forward chaining method to diagnose bone fractures in humans?*
3) *How this system can provide treatment recommendations based on the result analysis of the system?*
4) *How to create a website that introduces and provides information about broken bones?*

1.3 LIMITATION OF RESEARCH

The limitation in this research are:

1) *This expert system created to diagnose fractures, as well as provide information and solutions to address such causes, treatment, patangan food and food suggestions based on the indications are observed.*

2) *This expert system is under website.*
3) *To diagnose the disease, this expert system provides the questions in the form of indications experienced by users of the system.*
4) *This expert system uses forward chaining method.*
5) *In overall, this expert system can not replace a bone fracture specialist.*
6) *This expert system only covers broken bones or fractured bones (fractures) are accompanied by injury. These fractures consist of 7 types, they are:*
   a. *Closed fractures*
   b. *Open fractures*
   c. *Compression Fractures*
   d. *Comminuted fractures*
   e. *Fractures Avulsion*
   f. *Pathologic fractures*
   g. *Fractures Greenstick*

1.4 Purpose And Objectives

The purpose of this research are:

1) *To make a diagnosis expert system of fractures with forward chaining method, in order to simplify the system user in diagnosing the disease fracture.*
2) *With the expert system is expected to help determine the type of disease and broken bones fracture treatment method quickly and accurately.*
3) *Assist and facilitate expert fractures in determining the type of bone disease experienced by patients based on indications experienced.*

II. METHODOLOGY

3.1 Definiton of Expert System

Expert System is a system or program that acts like an expert or experts. The expert system is a knowledge-based system that is used to help solve the problems that exist in the real world. (Siswanto, 2010: 117).

Computer knowledge-based expert system is a computer program that has the knowledge derived from the human who is knowledgeable (experts) in a particular domain, where knowledge here is very minimal human knowledge dissemination, expensive and hard to come by. Here the expertise of humans to that knowledge to solve problems, as humans do.

Although the expert system can solve the problem in a finite domain based on the knowledge that is put into it, but can not complete expert system that can not be resolved humans. Therefore, the reliability of the expert system lies in the knowledge that is put into it. The conditions in which the expert system can assist people in resolving the problem, they are:

1) *Requires a lot of experts, but the number of experts availability is limited.*
2) *Critical Consideration should be done in a short time to avoid things that are not desirable.*
3) *Optimal results, as in digestion or configuration.*
4) *A large amount of data that must be continuously researched by experts. (Siswanto, 2010)*

3.2 Forward Chaining Method

Forward chaining method is a technique of reasoning used in an expert system. Forward chaining method is tracking ahead which start of a set of facts to look for rules that match the guesses / hypothesis that there towards the conclusion. According Siswanto (2010: 121) forward chaining sometimes called data-driven, because the inference engine uses the information specified by the user to move to a whole network of logic 'AND' and 'OR' to a terminal defined as object.

When the inference engine can not determine the object, it will ask for other information. Rules which define the object, forming a path that leads to the object. Therefore, only one way to achieve one object is to meet all the rules.

3.3 Best-First Search Technique

Best-First Search Technique is a search technique that uses knowledge of an issue to do a search guide toward the node where the solution is located. This kind of search is also known as heuristics. The approach taken is to find the best solution based on the knowledge that searches can be determined to be at the start of where and how to use the best process to find solutions. The Advantage of this type of search is to reduce the computational burden because the only solution that gives any hope of being tested and will stop only when the solution is already approaching the best. This is a model that resembles the way people take the resulting solution is a solution that is absolutely true.

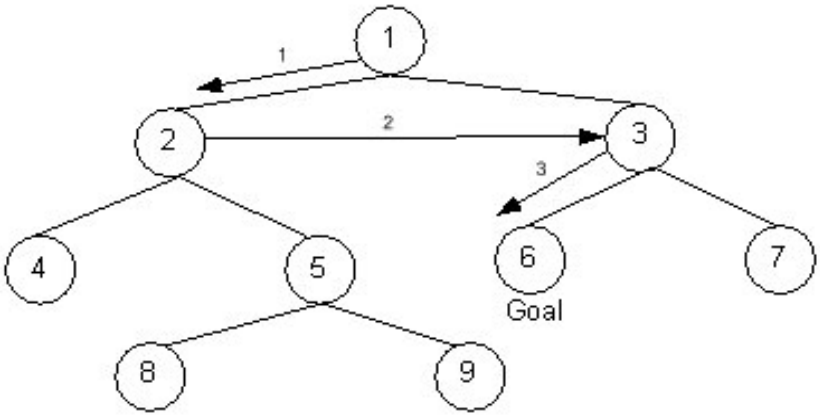

Fig. 1 Best-First Search Technique (Siswanto, 2010)

3.4 BONE FRACTURE

A fracture is a condition in which bone continuity is lost, either locally or in partial (Rasjad, 1998 dalam Mutaqin, 2008). In general, the state of clinical fractures can be classified into Closed fracture (simple fracture), namely bone fracture fragments did not penetrate the skin and an open fracture (compound fracture) are fractures that have a relationship with the outside world through a wound in the skin and soft tissues (Mutaqin, 2008).

This fracture can be experienced by a person when traumatized direct or indirect trauma. Fractures have a profound impact on aspects of life of patients who experienced it. Patients with fractures have a tendency to impaired mobilization during fracture healing.

Based on the impact of the effect on the lives of patients with fractures, precise handling is needed. The principle of treatment including reduction of fracture, immobilization, and return to normal function and strength with rehabilitation (Smeltzer & Bare, 2002). Handling of fracture can be obtained from a variety of health care facilities. Health service facilities used by members of the community consisted of a hospital, doctor's office, clinic or pustu, health workers, and herbalists or traditional medicine (Notoatmodjo, 2010).

The use of a traditional medicine is still an option for someone who had fractures to treat pain. Data from the health profile of Indonesia in 2007 said that the traditional treatment average is still 6.23% become the people's choice when they were ill, ie a 6.09% of urban communities and 6.37% of rural communities. However, often people still rely on traditional medicine chiropractors, although fracture suffered fractures that are not mild or modest, such as a fracture that changes shape or open fracture. This causes increased cases of infection of wounds addressed in the treatment of fractures resulting bone expert. During the period 1998-2000 there were 56 cases of disability from 1,224 cases of limb fractures treated at Hasan Sadikin Hospital clinic, whereas in the 2003-2007 period, the number of such cases has increased to 150 people. Of these 150 patients, 22 patients had an infection, 32 patients had deformities that even to save his soul is required amputation (Kompas, February 2008).

III. ANALYSIS AND DESIGN SYSTEM

4.1 FORWARD CHAINING REASONING TECHNIQUE

Inference that is used to reach the conclusions that suit their needs. Inference mechanism for the diagnosis of dental and oral diseases is to use forward chaining technique (advanced reasoning) who started their search towards the conclusion of a set of data. In this expert system design forward chaining process begins with the observation process through data collection and fact diagnosis, causes and treatment. Each of facts and data interconnected causes resulting in a conclusion in the form of diagnosis and treatment process. This can be visualized in the form of knowledge representation technique is one of the rules of production, generally contains a condition (IF) and action (THEN).

4.2 BEST FIRST SEARCH PATTERN

Search techniques which used in this research is best first search is looking for some solutions (more than one diagnosis) as solving problems or diagnoses of indications proposed end user. Selection of this technique in diagnosing diseases caused bone fractures is expected to provide solutions for consideration in the differential diagnosis of diagnosing any disease.

4.3 MANUAL PROCESS

This section describes the examples of cases in diagnosing the disease early elections fracture of indications to a diagnosis target according to predefined search techniques. Eg disease will be diagnosed comminuted fracture (due to be crushed). At the beginning, the user entered a selection of indications, for example:

- *1st indication : Transformation*
- *2nd indication : Can not be moved / disfunction*
- *3rd indication : hypovolemic shock*
- *4th indication : Fragments of bone*

For the 1st indication (transformation), is detected in six indication groups from six diagnoses; Closed fracture (KG1), Open fracture (KG2), Fracture compression (KG3), Comminuted fractures (KG4), Fractures Avulsion (KG5), Pathologic fractures (KG6), Initial search is as follows:

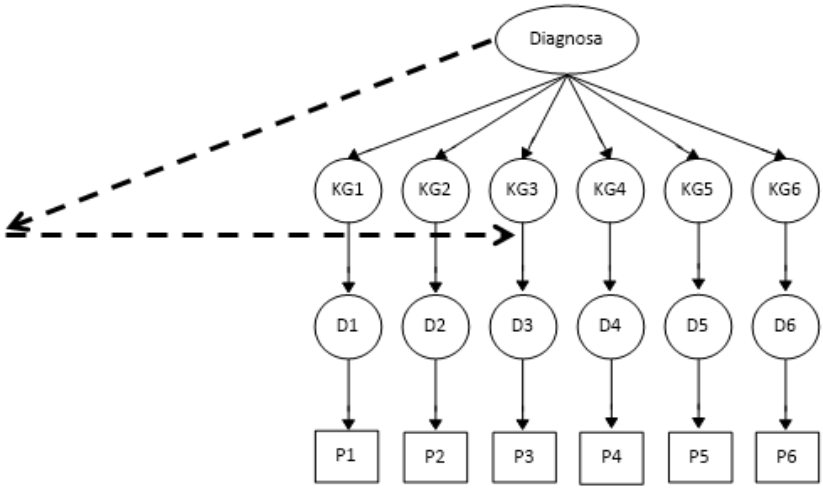

Fig. 2 The first symptom search

Then the inference engine (program) will check the input range of the first indication and the second indication (can not be moved / disfunction) which turned out to be only the symptom group KG1, KG2, KG4 and KG5. Like wise when symptoms 3 selection being part of a group of symptoms that are processed, the result of its detection remains on four groups of symptoms (KG1, KG2, KG4 and KG5). The process is described in the figure below:

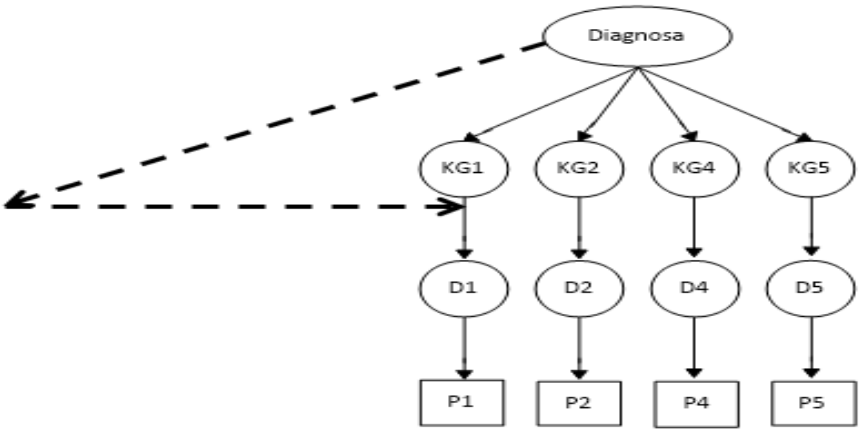

Fig. 3 Search for 1st indication, 2nd indication, and 3rd indication

The results of the final diagnoses of these searches came after four symptoms processed by the inference engine and as a result there are only two matches in two groups of symptoms that KG2 and KG4 owned by the diagnosis of diseases open fractures (D2) and fractures due to run over / comminuted (D4), It produces programs that provide diagnosis output only Fractures Open (compound) and a comminuted fracture (Because crushed). These results also show these programs with the search pattern best first search is already able to provide the differential diagnosis as a cover shortcomings of previous studies. Search this end are described in the figure below:

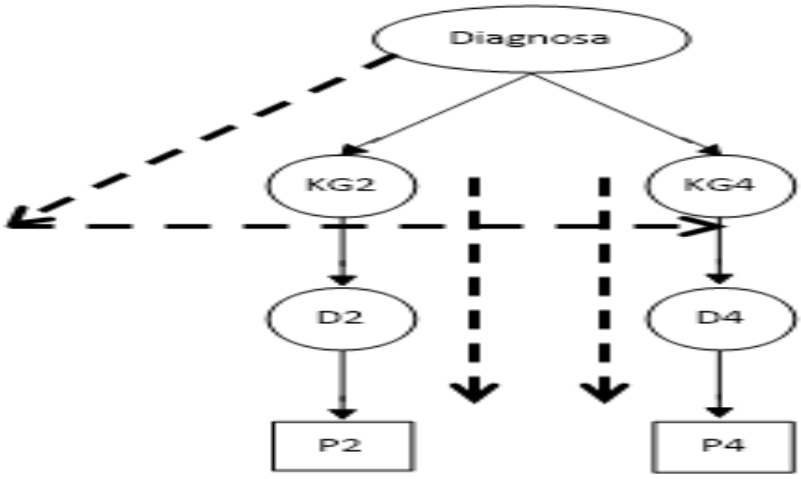

Fig. 4 Search All Enter Indications

4.4 TREE DIAGRAM

The tree diagram is a draft that is used to build an expert system and as a tool used to divide large categories into a smaller level or detailed. The tree diagram will help in simplifying a complex problem and make it easier to obtain the composition of the knowledge base and rules as well as determining factor of certainty of a diagnosis of fractures.

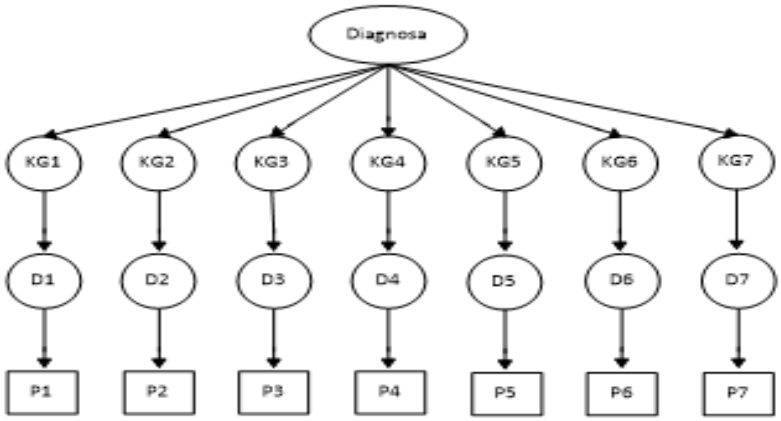

Fig. 5 Tree Diagram

Details:
KG : Symptoms Groups
D : Disease Diagnosis
P : Treatment

TABLE 1
LABELING GROUP SYMPTOMS IN TREE DIAGRAM

LABEL	SYMPTOMS GROUPS
KG1	G001, G002, G003, G004, G005, G007, G008, G009, G012
KG2	G001, G002, G003, G004, G005, G006, G007, G011, G012, G013
KG3	G001, G002, G003, G005, G007, G008, G009, G012, G014
KG4	G001, G002, G003, G004, G005, G007, G009, G011, G012, G016
KG5	G001, G002, G003, G004, G005, G007, G008, G009, G010, G012
KG6	G001, G002, G003, G005, G007, G008, G009, G012, G015
KG7	G001, G002, G003, G005, G009, G012

Details:
- *G001 Swelling*
- *G002 Pain*
- *G003 Half pain*
- *G004 disfunction*

- *G005 Excessive muscle contraction*
- *G006 Bone ends visible*
- *G007 Transformation*
- *G008 The sound of crunching on broken bones*
- *G009 Bruised*
- *G010 Can not be bent at the joints / The joint is locked*
- *G011 Shock body*
- *G012 Numb / Decreased sensation*
- *G013 Breaks in the skin accompanied by bleeding*
- *G014 Osteoporosis*
- *G015 Cancer*
- *G016 Fragments of bone*

TABLE 2
LABELLING DIAGNOSIS IN TREE DIAGRAM

LABEL	DISEASE NAME
D1	CLOSED FRACTURES
D2	OPEN FRACTURES (COMPOUND)
D3	COMPRESSION FRACTURES
D4	COMMINUTED FRACTURES
D5	FRACTURES AVULSION
D6	PATHOLOGIC FRACTURES
D7	GREENSTICK FRACTURES

IV. IMPLEMENTATION

4.1 USE CASE DIAGRAM

A use case is a methodology used in system analysis to identify, clarify, and organize system requirements. In this context, the term "system" refers to something being developed or operated, such as a mail-order product sales and service Web site. Use case diagrams are employed in UML (Unified Modeling Language), a standard notation for the modeling of real-world objects and systems. Use case diagram of the expert system diagnosis fractures were as follows:

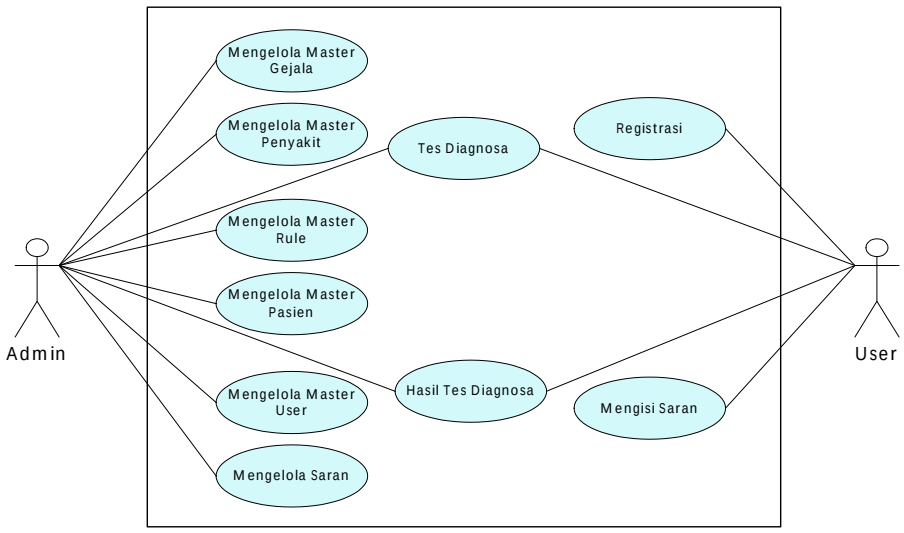

Fig. 6 Use Case Diagram

4.2 CLASS DIAGRAM

Class diagram is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

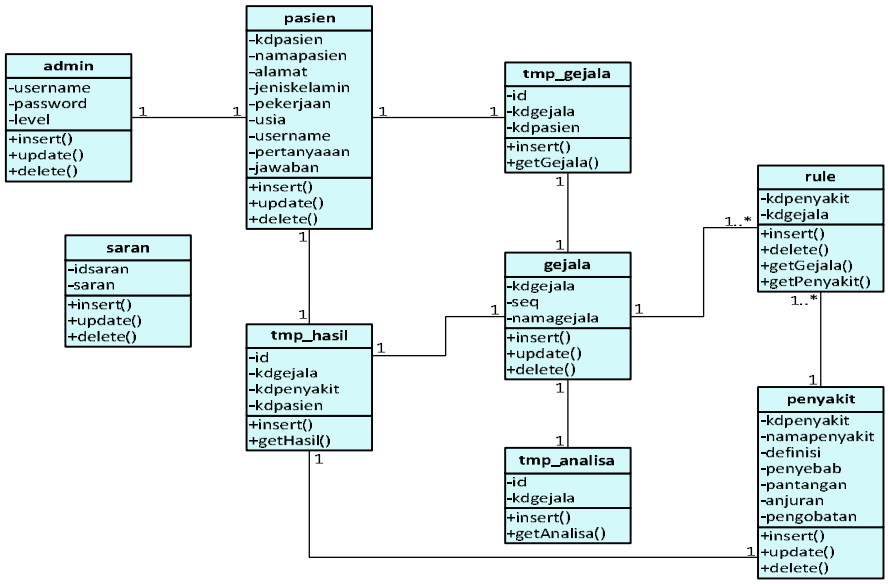

Fig. 7 Class Diagram

4.3 USER INTERFACE

1) User Interface for Pre-Diagnostic Tests

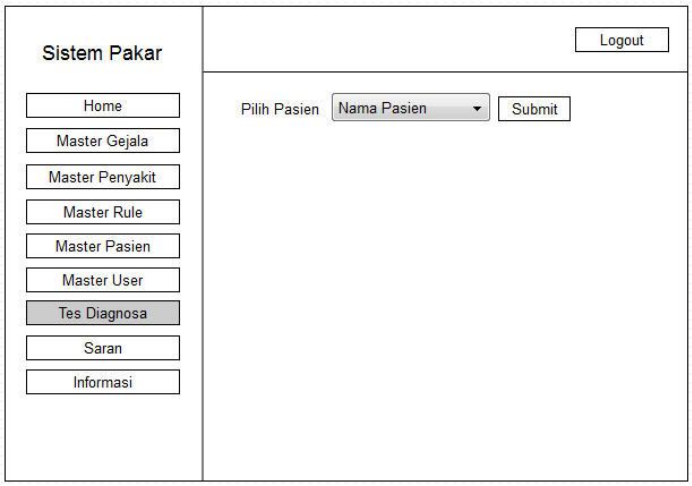

Fig. 8 User Interface for Pre-Diagnostic Tests

2) User Interface for Diagnostic Tests

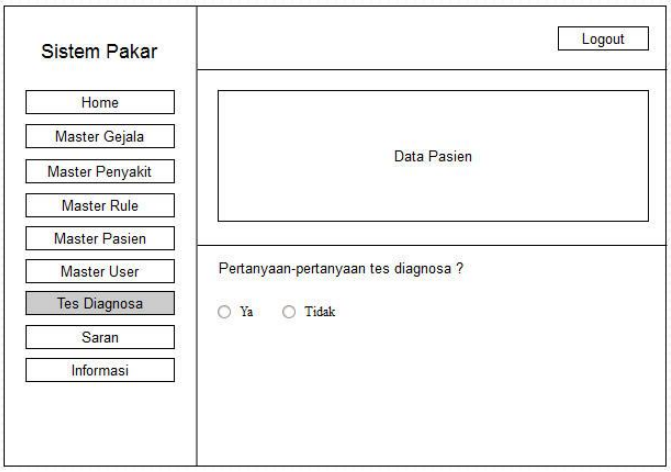

Fig. 9 User Interface for Diagnostic Tests

3) User Interface for Diagnostic Test Results

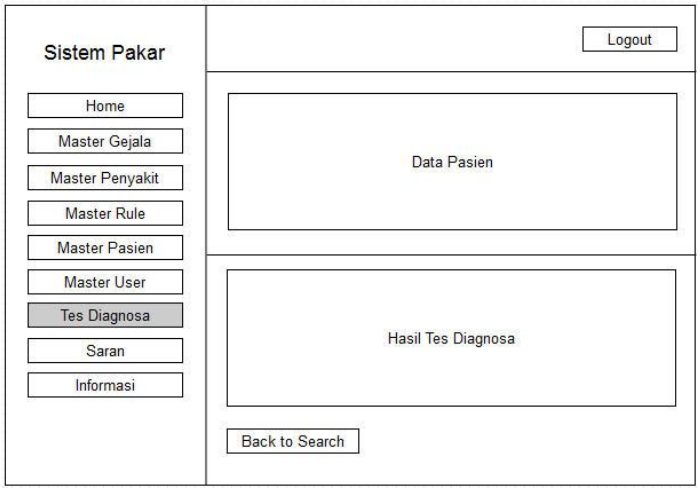

Fig. 10 User Interface for Diagnostic Test Results

V. CONCLUSION

The conclusion that the author can be taken from the results of the implementation and evaluation of this research are as follows:

1) *Expert systems bone fractures with forward chaining method created to help people with broken bones who do not know the types of bone fractures.*
2) *This expert system provides some information related to fractures, among other things: how the treatment of bone fractures, food taboos and advice for people with fractures and a fracture treatment recommendations.*
3) *Inference engine works well, in accordance with the rules that have been programmed in advance.*
4) *Making use MySQL database to store knowledge base and data to facilitate in adding, editing, and deletion of knowledge base.*

REFERENCES

[1] Arief, M. Rudianto. 2011. Pemrograman Web Dinamis Menggunakan Php dan Mysql. Yogyakarta: ANDI.
[2] Riyanto. 2010. XAMPP. Yogyakarta: Gava Media.
[3] Siswanto. 2010. Kecerdasan Tiruan. Yogyakarta: Graha Ilmu
[4] Sibero, Alexander.F.K. 2011. Kitab Suci Web Programing. Yogyakarta: MediaKom.
[5] Sutojo, T. Mulyanto, E. dan Suhartono, V. 2011. Kecerdasan Buatan. Yogakarta: ANDI.
[6] Triandini, Evi dan I Gede, Suardika. 2012. Step by Step Desain Proyek Menggunakan UML. Yogyakarta: ANDI.
[7] Wahana Komputer. 2010. Mendesain Website Dinamis dan Menarik dengan Adobe Dreamweaver CS4.
[8] Yasin, V. 2012. Rekayasa Perangkat Lunak Berorientasi Objek "Pemodelan, Arsitektur dan Perancangan (Modeling, Architecture and Design)". Jakarta: Mitra Wacana Media.
[9] Andreswari, D. Efendi, R. dan Yarnia, N. 2013. Sistem Pakar untuk Diagnosis Penyakit Tulang pada Manusia Menggunakan Metode Dempster-Shafer Berbasis WAP dengan WML dan PHP. Jurnal Ilmiah Bidang Sains – Teknologi Disiplin dan Antar Disiplin. Vol. 1, No. 11.
http://repository.unib.ac.id/6825/1/B%207%20Jurnal%20teknosia%20Maret%202013.pdf
[10] Iriani, S. 2015. Penerapan Metode Backward Chaining Pada Sistem Pakar Diagnosa Penyakit Patah Tulang Manusia. Indonesian Journal and Network Security, Vol. 4, No.1.
http://ijns.org/journal/index.php/ijns/article/download/1319/1307.
[11] Kurnia, S.H. Kosasih C.E. dan Prawesti, A.P. 2012. Faktor-Faktor yang Melatarbelakangi Pasien Patah Tulang Berobat ke Pengobatan Tradisional Ahli Tulang Sumedang. Jurnal Universitas Padjajaran, Vol.1, No.1.
http://jurnal.unpad.ac.id/ejournal/article/view/731/777.
[12] Prenamia, H.C. 2015. Aplikasi Visualisasi Struktur Tulang dan Penyakit Tulang Manusia. Jurnal Ilmiah Mahasiswa Universitas Surabaya. Vol. 4, No.2.
https://journal.ubaya.ac.id/index.php/jimus/article/view/1080/1046
[13] Triyono, P. dan Murinto. 2015. Aplikasi Pengolahan Citra untuk Mendeteksi Fraktur Tulang dengan Metode Deteksi Tepi Canny. Jurnal Informatika. Vol. 9, No. 2.
http://journal.uad.ac.id/index.php/JIFO/article/view/2966/1721.
Wardhani, J.R. Soediyono, E. dan Krismiyati. 2011. Perancangan Program Sistem Pakar untuk Mendiagnosa Penyakit Sendi dan Tulang pada Manusia dengan Memanfaatkan Teknologi Dongle. Jurnal Teknologi dan Informasi – Aiti, Vol.8, No. 2.