ORIGINAL ARTICLE

A PROPOSED EXPERT SYSTEM FOR FOOT DISEASES DIAGNOSIS

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ABSTRACT

Background: Foot is a complicated structure with 26 bones, 33 joints, and lots of muscles, nerves, ligaments of different types. Any part of the foot might be affected. Several foot disorders might be present with just dull pain, but on the other hand the other foot disorders can be extremely severe and limit the capability to walk or tolerate weight. The largest part of minor cases of foot pain is treated at home with special care. When severe pain is encountered, it requires some kind of medical care. If appropriate treatment of foot pain is not taken quickly, it can lead to damage in the foot. **Objectives**: The main goal of this expert system is to get the appropriate diagnosis of disease and the correct treatment. **Methods**: In this paper the design of the proposed Expert System which was produced to help Podiatric physician in diagnosing many of the foot diseases such as : Clubfoot, In toeing, Stress Fracture, Foot or Ankle Fracture, Foot Sprain, Turf Toe, Flat feet, Plantar Fasciitis, Warts, Bunion, Rheumatoid Arthritis, Gout, Heel Spur, Athlete's Foot, Morton's Neuroma, Cellulitis, Frostbite, and Gangrene. The proposed expert system presents an overview about foot diseases are given, the cause of diseases are outlined and the treatment of disease whenever possible is given out. SL5 Object Expert System language was used for designing and implementing the proposed expert system. **Results**: The proposed foot diseases diagnosis expert system was evaluated by Medical students and they were satisfied with its performance. **Conclusions**: The Proposed expert system is very useful for Podiatric physician, patients with foot problem and newly graduated physician.

Keywords: *Artificial Intelligence, Expert Systems, SL5 Object, Foot diseases, Language.*

1. INTRODUCTION

Feet are actually are located at the end of leg and on which human and some animal stands. Although the foot is a member of small size, but the full underpin to the body. The foot included when most of the mammals, birds and reptiles, some of the claws as well as nails, but the human has only toenails. The foot is very important for human. It is used in many tasks: Movement, Stand up, Jumping, Body balance. Anatomically foot can be divided into three areas: Hindfoot, Midfoot, and Forefoot. Human foot consists of 26 bones, 33 joints, and lots of muscles, nerves, ligaments of different types. (as seen in Fig1). These bones are [14]:

- Bones of the ankle is composed of seven bones or (the bones of the hock)
- Instep of a five bones.
- Fourteen foot phalanges or (the bones of the toes).

Figure 1: The figure presents the structure of the foot [14].

Foot diseases in many places are not treated by Foot specialists. Indeed, the presence of doctors and specialized centers for the treatment of foot is rare in much of the world. Foot diseases are very common these days, because most of foot problems are congenital defects in the foot structure and external influences [15].

Diagnosis of foot diseases is a very complex because the foot is small in size and other diseases may affect the foot. So they need Podiatric physician with wide experience of foot diseases. For all the aforementioned reasons, we have developed this expert system to help Podiatric physician in diagnosing many of the foot diseases, in order to prescribe the appropriate treatment [16].
Expert System is a computer application of Artificial Intelligence (AI) [2,4,6]; which contains a knowledge base and an inference engine [3]; the main components and details are represented in figure 2.
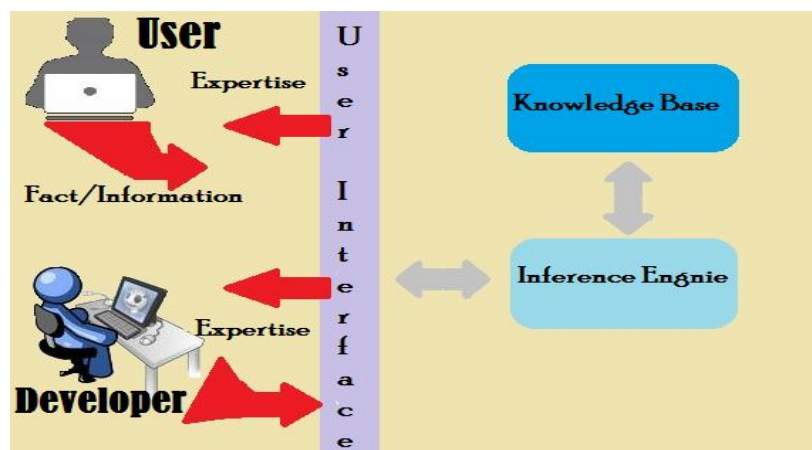
Figure 2: The figure presents the Main Components of an Expert System, Designed by the authors.

The proposed Expert System for Foot Diseases Diagnosis was implemented using, SL5 Object language which stands for Simpler Level 5 Object [7]. It is a forward chinning reasoning expert system that can make inferences about facts of the world using rules, objects and take appropriate actions as a result. The SL5 Object engine is implemented in Delphi Embarcadero RAD Studio XE6 [8]. SL5 Object executes any Expert System looks like frames. It's easy for the knowledge engineer to build the Expert System and for the end users when they use the system.

2. MATERIALS AND METHODS

The proposed expert system performs diagnosis for eighteen foot diseases of all stages of the human life starting with newborn to the elderly by asking yes or no questions. The proposed expert system will ask the user to choose the correct answer in each screen. At the end of the dialogue session, the proposed expert system provides the diagnosis and recommendation of the disease to the user. Figure 3 shows a sample dialogue between the expert system and the user. Figure 4 shows how the users get the diagnosis and recommendation.

Figure 3: The figure presents shows when the system asks the user.

Figure 4: The figure shows diagnosis and recommendation of the expert system.

3. LITERATURE REVIEW

There is a lot of Expert System that were designed to diagnose diseases such as Eye, Endocrine, skin and other types of disease [9-13,17]. But there is no specialized expert system for diagnosis of foot diseases available free. Although it's linked to several human diseases such as: Diabetes, Skin and bacterial. Abu Naser and Aakila developed an expert system to help dermatologists in diagnosing skin diseases using CLIPS language [1]. Some of the skin diseases is related with foot diseases such as Warts. Type of Warts affect feet called Planter Warts. Talayeh Tabibi developed an expert system for diabetes diagnosis [5]. Some of the skin diseases are related to foot diseases such as loss of sensation in feet. MYCIN is a well-known expert system for diagnosing bacterial infections [6]. Some of the bacterial infections effect feet. Some of these Expert Systems are specialized in one specific disease and others in nine diseases. but the current proposed expert system is specialized in the diagnosis of eighteen foot diseases : Clubfoot, Intoeing, Stress Fracture, Foot or Ankle Fracture, Foot Sprain, Turf Toe, Flat feet, Plantar Fasciitis, Warts, Bunion, Rheumatoid Arthritis, Gout, Heel Spur, Athlete's Foot, Morton's Neuroma, Cellulitis, Frostbite, and Gangrene.

4. KNOWLEDGE REPRESENTATION

The main sources of the knowledge for this expert system are Podiatric physician and specializes websites for feet diseases. The captured knowledge has been converted into SL5 Object Knowledge base syntax (Facts, Rules and Object) [7]. Currently the expert system has 43 rules which cover eighteen foot diseases [14]:

Club Foot: Children or newborn suffered from club foot disease because a congenital problem that affects one or both feet. Infected Foot looks retort to the inside when the ankle joint. The patient with the disease and who have not been cured often moves on the ankle or on the sides of the foot. Later in the future, the patient will suffer from pain and limited mobility in the ankle joint. The probability of this disease is (1/1000) per child. Figure 5 shows Normal Foot and Club Foot disease [14].
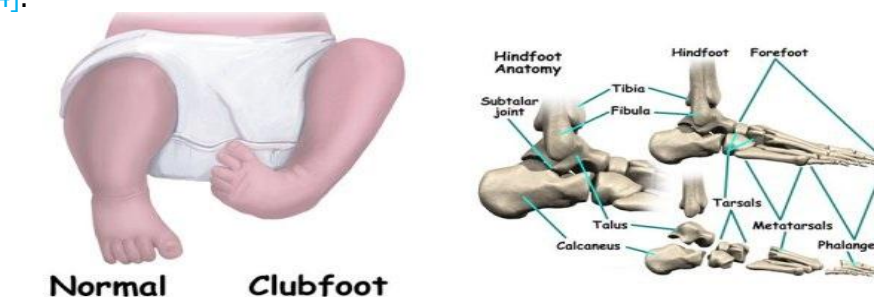
Figure 5: The figure shows the difference between normal and club foot [14].

Intoeing is a disease that children suffered from or toddler. It means that when a child walks or runs, the feet turn inward instead of pointing straight ahead as shown in Figure 6. The cause may be for this disease is one of three conditions:
- Curved foot (metatarsus adductus).
- Twisted shin (tibia torsion).
- Twisted thighbone (femoral anteversion).

Figure 6: The figure shows the difference between Normal Foot and metatarsus adductus [16].

Stress fractures are small cracks in a bone. It is caused by the repetitive application of force, often by overuse (as seen in Figure 7) such as:
- Running long distances.
- Repeatedly jumping up and down.
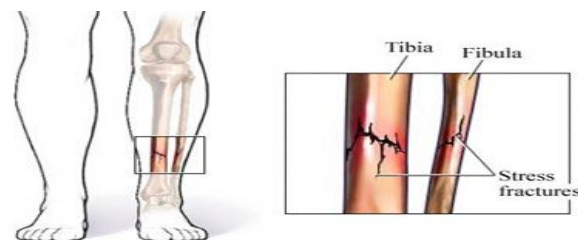
Figure 7: The figure presents shows small cracks in a bone [16].

Ankle Fractures is also known as an ankle (broken). It's often thought of as sports injuries. The cause may be one of the following:
- Rotating or twisting your ankle
- Rolling your ankle
- Falling or Tripping
- Impact during a car accident

Figure 8: The figure shows broken ankle [15].

Foot Sprain is an injury to the ligaments, which is damage to one or more ligaments in a joint (See Figure 9). The most common symptoms of foot sprain:
- Severe pain
- To infections
- Swelling of the joints, or the near side of the injury
- Bruises
- Inability to move a patient
- A lack of flexibility and effectiveness of some ligament injury

Figure 9: The figure shows an injury to the ligaments [15].

Turf Toe is an injury to the connective tissue between the foot and big toe as shown in Figure 10. The most common symptoms of turf toe include:

- Pain
- Swelling
- Limited joint movement at the base of one big toe

Figure 10: The figure shows an injury to the connective tissue between the foot and big toe [15].

Flat Feet: is a state in which the foot is flat soles, and thus lose the natural curvature, which is located on the side of the foot, this case shows significantly during the stand. Some individuals (an estimated 20–30% of the general population) have an arch that simply never develops in one foot (unilaterally) or both feet (bilaterally) as can be seen in Figure 11.


Figure 11: The figure shows flat foot and normal foot [14].

Plantar Fasciitis is a sharp pain on the bottom of your foot and connects your heel bone to your toes pain. It involves pain and inflammation of a thick band of tissue(See Figure 12).

Figure 12: The figure shows pain on the bottom of the foot [16].

Planter Warts is a type of wart, found on the soles of the feet. They can be very painful. Having many of them on your feet may cause problems walking or running as in Figure 13.
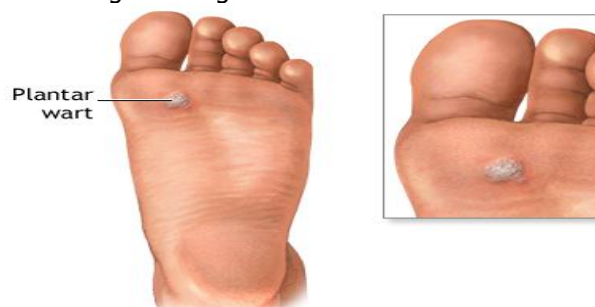
Figure 13: The figure shows types of wart [15].

A bunion is a bony bump that forms on the joint at the base of your big toe. A bunion forms when your big toe pushes against your next toe, forcing the joint of your big toe to get bigger and stick out. The skin over the bunion might be red and sore (See Figure 14).

Figure 14: The figure shows bony bump that forms on the joint at the base of big toe [15].

Rheumatoid Arthritis is a chronic inflammatory disorder that typically affects the small joints in your hands and feet. Causing a painful swelling that can eventually result in bone erosion and joint deformity as in Figure 15.

Figure 15: The figure shows chronic inflammatory disorder [16].

Gout is a kind of arthritis. It can cause an attack of sudden burning pain, stiffness, and swelling in a joint, usually a big toe. These attacks can happen over and over unless gout is treated. Over time, they can harm your joints, tendons, and other tissues. Gout is most common in men (See Figure 16).
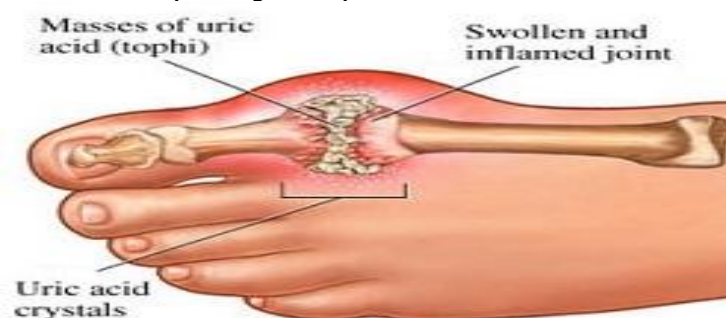
Figure 16: The figure shows Gout [15].

A heel spur is a calcium deposit causing a bony projecting from the back or underside of the heel bone that often makes walking painful. On an X-ray, a heel spur can extend forward by as much as a half-inch. Without visible X-ray evidence, the condition is called "heel spur syndrome" as in Figure 17.


Figure 17: The figure shows heel spur syndrome [15].

Athlete's Foot is a contagious skin infection that usually begins between the toes and soles of the feet. It's known as ringworm of the foot, tinea pedum, and moccasin foot. The signs and symptoms often include itching, scaling, and redness(See Figure 18).

Figure 18: The figure shows Athlete's Foot disease [15].

Morton's Neuroma is a swollen or thickened nerve in the ball of your foot. The main symptoms are pain and/or numbness, sometimes relieved by removing footwear. Causes a sharp and burning pain in the ball of the foot. A sharp severe pain, often described as a red hot needle may come on suddenly while walking. It's also known as Morton neuroma, Morton's metatarsalgia, Intermetatarsal space neuroma and Intermetatarsal neuroma as shown in Figure 19.
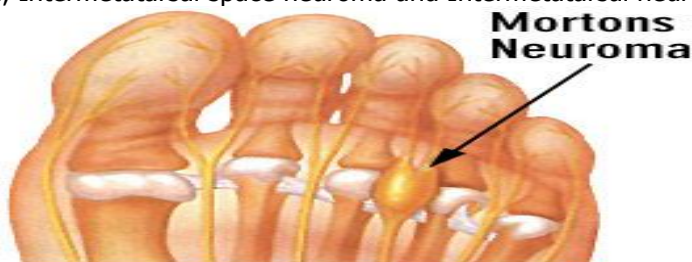
Figure 19: The figure shows Morton's Neuroma disease [16].

Cellulitis is a spreading bacterial infection of the skin and tissues beneath the skin. It has two types "Staphylococcus and Streptococcus" that are usually responsible for cellulitis, although many types of bacteria can cause the condition. The signs and symptoms include redness, tenderness, swelling, and warmth of the affected area (see Figure 20).

Figure 20: The figure shows Cellulitis disease [16].

Frostbite is the medical condition in which localized damage is caused to skin and other tissues due to freezing. Frostbite is most likely to happen in body parts farthest from the heart and those with large exposed areas. The frostbites are sometimes known as frostnip. The signs and symptoms often include(See Figure 21):
- Old skin and a prickling feeling
- Numbness
- Red, white, bluish-white or grayish-yellow skin
- Hard or waxy-looking skin
- Clumsiness due to joint and muscle stiffness
- Blistering after rewarming, in severe cases

Figure 21: shows Frostbite disease [15].

Gangrene is cell death and decomposition of body tissues due to infection and blockage of the arteries. Tissue death and rot, and usually occur on the outskirts of the human body, but they may infect anywhere in the skin and internal organs as seen in Figure 22.

Figure 22: The figure shows Gangrene disease [16].

5. LIMITATIONS

The current proposed expert system is specialized in the diagnosis only the following eighteen foot diseases : Clubfoot, Intoeing, Stress Fracture, Foot or Ankle Fracture, Foot Sprain, Turf Toe, Flat feet, Plantar Fasciitis, Warts, Bunion, Rheumatoid Arthritis, Gout, Heel Spur, Athlete's Foot, Morton's Neuroma, Cellulitis, Frostbite, and Gangrene.

6. SYSTEM EVALUATION

As a preliminary evolution, Dr. Besan Shaheen and other Medical students tested this proposed Expert System and they were satisfied with its performance, efficiency, user interface and ease of use.

7. CONCLUSION

In this paper, a proposed expert system was presented for helping Podiatric physician in diagnosing patients with eighteen different possible foot diseases. Podiatric physician and foot diseases patients can get the diagnosis faster and more accurate than the traditional diagnosis. This expert system does not need intensive training to be used; it is easy to use and has user friendly interface. It was developed using SL5 Object Expert System language.

8. FUTURE WORK

This expert system is considered to be a base of future ones; more foot diseases are planned to be added and to make it more accessible to users from anywhere at any time.

9. EXPERT SYSTEM SOURCE CODE

```
! Written By ALi Mahdi
ATTRIBUTE Is the person a child or a newborn with a foot deformity SIMPLE INIT TRUE
ATTRIBUTE Is the person a child or a toddler with toes that point in SIMPLE INIT TRUE
ATTRIBUTE Did your foot pain begin after intense physical activity SIMPLE INIT TRUE
ATTRIBUTE Did your foot pain or swelling begin with an injury or accident SIMPLE INIT TRUE
ATTRIBUTE Does your foot look flat and are you experiencing foot pain on ankle  with swelling SIMPLE INIT TRUE
ATTRIBUTE Is there swelling or redness on top of your foot SIMPLE INIT TRUE
ATTRIBUTE Are you unable to stand or walk on your foot and is your foot swollen or bruised SIMPLE INIT TRUE
ATTRIBUTE Is the pain on the bottom of your foot between the ball and the heel SIMPLE INIT TRUE
ATTRIBUTE aaa SIMPLE INIT TRUE
ATTRIBUTE Is the pain only in one toe and did it start after u hit twisted or jammed the toe SIMPLE INIT TRUE
ATTRIBUTE Does your foot hurt somewhere between the heel and the ball of the foot  first steps SIMPLE INIT TRUE
ATTRIBUTE Do you have a small hard thickened area of skin on the bottom of the foot or toe SIMPLE INIT TRUE
ATTRIBUTE Do you have pain in your big toe or in it joint and big toe seem to be deformed point SIMPLE INIT TRUE
ATTRIBUTE Do you have a fever and are your joints tender sore red or swollen SIMPLE INIT TRUE
ATTRIBUTE Do you have a red swollen big toe that hurts when anything touches it SIMPLE INIT TRUE
ATTRIBUTE Do you have intense pain near your heel when you put weight on it SIMPLE INIT TRUE
ATTRIBUTE Do you have a moist white area of peeling skin and itching between toes and scaling SIMPLE INIT TRUE
ATTRIBUTE Do you have a burning pain at the base of a toe on the bottom of u foot along with tingling SIMPLE INIT TRUE
ATTRIBUTE Is a part of your foot red swollen warm and tender SIMPLE INIT TRUE
ATTRIBUTE Have your toes been exposed to very cold temperatures SIMPLE INIT TRUE
```

ATTRIBUTE Have you lost sensation in your toes or are they discolored and foul smelling SIMPLE INIT TRUE
ATTRIBUTE start SIMPLE
INSTANCE the domain ISA domain
  WITH start := TRUE

INSTANCE the application ISA application
 WITH title display := introduction
 WITH conclusion display := Conc
  WITH simple query text := "
 * is *"
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 := 0,0,0
  WITH fill color := 255,0,0
  WITH justify IS left
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text :="

<div align="center">Foot Diagnosis Expert System
Written By Ali Mahdi</div>

This Expert system is written in Simpler Level 5 Object (SL5 Object) that Demonstrate the use of some of the System classes, Instances, Rules, etc.
This Expert System diagnoses Foot Diseases through a dialogue between the System and the End User.
The Conclusion of the finding is displayed and a recommend is given for the End User to diagnoses the Diseases."

INSTANCE Conc ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1] := title textbox
  WITH items [2] := diagnosis textbox
  WITH items [3] := recommend textbox

INSTANCE title textbox ISA textbox
  WITH location := 20,10,800,70
  WITH pen color := 0,0,0
  WITH fill color := 255,0,0
  WITH justify IS center
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
 WITH text := " The Conclusion of the Foot Diagnosis Expert System"

INSTANCE diagnosis textbox ISA textbox
  WITH location := 20,110,800,130
  WITH pen color := 0,0,0
  WITH fill color := 255,255,255
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 12
  WITH text :=" --===--"

INSTANCE recommend textbox ISA textbox
  WITH location := 20,280,800,130
  WITH pen color := 0,0,0

```
        WITH fill color := 255,255,255
        WITH justify IS left
        WITH font := "Arial"
        WITH font size := 12
        WITH text :=" --===--"
```

RULE R0
IF start
THEN ASK Is the person a child or a newborn with a foot deformity

RULE R1
IF Is the person a child or a newborn with a foot deformity = TRUE
THEN text OF diagnosis textbox := " CLUBFOOT is a common disorder in which one or both feet are turned inward or downward.   "
AND text OF recommend textbox := " See your doctor. Treatment is usually more effective when started early. "
ELSE   NOT Is the person a child or a newborn with a foot deformity

RULE R2
IF NOT Is the person a child or a newborn with a foot deformity
THEN ASK Is the person a child or a toddler with toes that point in

RULE R3
IF Is the person a child or a toddler with toes that point in = TRUE
AND NOT Is the person a child or a newborn with a foot deformity
THEN text OF diagnosis textbox := " The cause may be FEMORAL ANTEVERSION, TIBIAL TORSION or METATARSUS ADDUCTUS, commonly called intoeing. "
AND text OF recommend textbox := " See your doctor. "
ELSE NOT Is the person a child or a toddler with toes that point in

RULE R4
IF NOT Is the person a child or a toddler with toes that point in
THEN ASK Did your foot pain begin after intense physical activity

RULE R5
IF Did your foot pain begin after intense physical activity = TRUE
AND NOT Is the person a child or a toddler with toes that point in
THEN text OF diagnosis textbox := " You may have a STRESS FRACTURE of the bones in your foot.
The pain from stress fractures usually decreases with rest and increases with activity.   "
AND text OF recommend textbox := " Apply ice to the foot and take an over-the-counter
anti-inflammatory medicine to relieve pain. See your doctor if you don't feel better within a few days. "
ELSE NOT Did your foot pain begin after intense physical activity

RULE R6
IF NOT Did your foot pain begin after intense physical activity
THEN ASK Did your foot pain or swelling begin with an injury or accident

RULE R7
IF Did your foot pain or swelling begin with an injury or accident = TRUE
AND NOT Did your foot pain begin after intense physical activity
THEN NOT aaa
ELSE NOT Did your foot pain or swelling begin with an injury or accident

RULE R8
IF NOT aaa
THEN ASK Is there swelling or redness on top of your foot

RULE R9
IF Is there swelling or redness on top of your foot = TRUE
AND NOT aaa
THEN text OF diagnosis textbox := " Your pain may be from DAMAGE TO THE SKIN OR TENDONS on top of the foot. "

AND text OF recommend textbox := " Use ice and an over-the-counter anti-inflammatory medicine. See your doctor if the pain doesn't get better within a few days."
ELSE NOT Is there swelling or redness on top of your foot

RULE R10
IF NOT Did your foot pain or swelling begin with an injury or accident
THEN ASK Does your foot look flat and are you experiencing foot pain on ankle with swelling

RULE R11
IF NOT Is there swelling or redness on top of your foot
THEN ASK Are you unable to stand or walk on your foot and is your foot swollen or bruised

RULE R12
IF Does your foot look flat and are you experiencing foot pain on ankle with swelling = TRUE
AND NOT Did your foot pain or swelling begin with an injury or accident
THEN text OF diagnosis textbox := " You may have FALLEN ARCHES, a condition known as FLAT FEET. "
AND text OF recommend textbox := " Wear shoes that have solid support and avoid weight-bearing activities   until the pain and swelling go away. See your doctor if your symptoms persist."
ELSE NOT Does your foot look flat and are you experiencing foot pain on ankle with swelling

RULE R13
IF Are you unable to stand or walk on your foot and is your foot swollen or bruised = TRUE
AND NOT Is there swelling or redness on top of your foot
THEN text OF diagnosis textbox := " Your FOOT or ANKLE BONE may be FRACTURED. "
AND text OF recommend textbox := " See your doctor. Apply ice to reduce the swelling and take an over-the-counter analgesic such as ibuprofen to help relieve pain."
ELSE NOT Are you unable to stand or walk on your foot and is your foot swollen or bruised

RULE R14
IF NOT Are you unable to stand or walk on your foot and is your foot swollen or bruised
THEN ASK Is the pain on the bottom of your foot between the ball and the heel

RULE R15
IF Is the pain on the bottom of your foot between the ball and the heel = TRUE
AND NOT Are you unable to stand or walk on your foot and is your foot swollen or bruised
THEN text OF diagnosis textbox := " You may have SPRAINED the LIGAMENT in the arch of the foot. "
AND text OF recommend textbox := " Use shoes with an arch support and take   an over-the-counter anti-inflammatory medicine. See your doctor if the pain is severe or if you can't walk on the foot."
ELSE NOT Is the pain on the bottom of your foot between the ball and the heel

RULE R16
IF NOT Is the pain on the bottom of your foot between the ball and the heel
THEN ASK Is the pain only in one toe and did it start after u hit twisted or jammed the toe

RULE R17
IF Is the pain only in one toe and did it start after u hit twisted or jammed the toe = TRUE
AND NOT Is the pain on the bottom of your foot between the ball and the heel
THEN text OF diagnosis textbox := " Your pain may be from TURF TOE (a sprained big toe), from a PULLED LIGAMENT or from a FRACTURE. "
AND text OF recommend textbox := " See your doctor. Applying ice or taping the sore toe to the next toe can help relieve the pain."
ELSE NOT Is the pain only in one toe and did it start after u hit twisted or jammed the toe

RULE R18
IF NOT Is the pain only in one toe and did it start after u hit twisted or jammed the toe
THEN ASK Does your foot look flat and are you experiencing foot pain on ankle with swelling

RULE R19
IF Does your foot look flat and are you experiencing foot pain on ankle with swelling = TRUE
AND NOT Is the pain only in one toe and did it start after u hit twisted or jammed the toe
THEN text OF diagnosis textbox := " You may have FALLEN ARCHES, a condition known as FLAT FEET. "

AND text OF recommend textbox := " Wear shoes that have solid support and avoid weight-bearing activities   until the pain and swelling go away. See your doctor if your symptoms persist. "
ELSE NOT Does your foot look flat and are you experiencing foot pain on ankle with swelling

RULE R20
IF NOT Does your foot look flat and are you experiencing foot pain on ankle with swelling
THEN ASK Does your foot hurt somewhere between the heel and the ball of the foot first steps

RULE R21
IF Does your foot hurt somewhere between the heel and the ball of the foot first steps = TRUE
AND NOT Does your foot look flat and are you experiencing foot pain on ankle with swelling
THEN text OF diagnosis textbox := " Your pain may be from irritation of the arch ligament and tissues,
called PLANTAR FASCIITIS. "
AND text OF recommend textbox := " Try to keep weight off your foot until the inflammation is better.
Use an anti-inflammatory medicine to relieve the pain. Rest and apply ice to the sore area. See your doctor if your pain doesn't get better."
ELSE NOT Does your foot hurt somewhere between the heel and the ball of the foot first steps

RULE R22
IF NOT Does your foot hurt somewhere between the heel and the ball of the foot first steps
THEN ASK Do you have a small hard thickened area of skin on the bottom of the foot or toe

RULE R23
IF Do you have a small hard thickened area of skin on the bottom of the foot or toe = TRUE
AND NOT Does your foot hurt somewhere between the heel and the ball of the foot first steps
THEN text OF diagnosis textbox := " These thickened areas are likely to be CORNS. If they appear to have small granules in them, they may be WARTS. A small piece of retained glass can also cause these problems."
AND text OF recommend textbox := " Use an over-the-counter corn or wart remover. Remove the dead skin after each treatment. See your doctor if you have diabetes, if the corns or warts are painful or inflamed, or if they're large, very numerous or resistant to over-the-counter medicines. "
ELSE NOT Do you have a small hard thickened area of skin on the bottom of the foot or toe

RULE R24
IF NOT Do you have a small hard thickened area of skin on the bottom of the foot or toe THEN
ASK Do you have pain in your big toe or in it joint and big toe seem to be deformed point

RULE R25
IF Do you have pain in your big toe or in it joint and big toe seem to be deformed point = TRUE
AND NOT Do you have a small hard thickened area of skin on the bottom of the foot or toe
THEN text OF diagnosis textbox := "Your toe deformity may be from a collapsing joint, commonly called a BUNION."
AND text OF recommend textbox := "Wear comfortable shoes that provide plenty of room for your toes. Avoid high-heeled shoes and apply ice, or try over-the-counter medicines such as acetaminophen or ibuprofen to relieve the pain. See your doctor if your condition worsens."
ELSE NOT Do you have pain in your big toe or in it joint and big toe seem to be deformed point

RULE R26
IF NOT Do you have pain in your big toe or in it joint and big toe seem to be deformed point
THEN ASK Do you have a fever and are your joints tender sore red or swollen

RULE R27
IF Do you have a fever and are your joints tender sore red or swollen = TRUE
AND NOT Do you have pain in your big toe or in it joint and big toe seem to be deformed point
THEN text OF diagnosis textbox :=" RHEUMATOID ARTHRITIS may be the cause of the pain. "
AND text OF recommend textbox := " See your doctor. Treatment for rheumatoid arthritis may include medications, physical therapy, exercise and, in some cases, surgery."
ELSE NOT Do you have a fever and are your joints tender sore red or swollen

RULE R28
IF NOT Do you have a fever and are your joints tender sore red or swollen
THEN ASK Do you have a red swollen big toe that hurts when anything touches it

RULE R29
IF Do you have a red swollen big toe that hurts when anything touches it = TRUE
AND NOT Do you have a fever and are your joints tender sore red or swollen
THEN text OF diagnosis textbox := " You may have GOUT."
AND text OF recommend textbox := " See your doctor."
ELSE NOT Do you have a red swollen big toe that hurts when anything touches it

RULE R30
IF NOT Do you have a red swollen big toe that hurts when anything touches it
THEN ASK Do you have intense pain near your heel when you put weight on it

RULE R31
IF Do you have intense pain near your heel when you put weight on it = TRUE
AND NOT Do you have a red swollen big toe that hurts when anything touches it
THEN text OF diagnosis textbox := " Your pain may be from a HEEL SPUR, a small bulge from the heel bone, but more likely to be due to PLANTAR FASCIITIS. "
AND text OF recommend textbox := " See your doctor. He or she can suggest special stretching exercises to help relieve the pain. A soft insole or a firm insole with a hole under the spur may also help. "
ELSE NOT Do you have intense pain near your heel when you put weight on it

RULE R32
IF NOT Do you have intense pain near your heel when you put weight on it THEN
ASK Do you have a moist white area of peeling skin and itching between toes and scaling

RULE R33
IF Do you have a moist white area of peeling skin and itching between toes and scaling = TRUE
AND NOT Do you have intense pain near your heel when you put weight on it
THEN text OF diagnosis textbox := " These may be symptoms of a fungal infection called ATHLETE'S FOOT. "
AND text OF recommend textbox := " Use an over-the-counter athlete's foot spray or cream. Wash your feet thoroughly with soap and water twice a day. Be sure to dry your feet completely. If your symptoms aren't better in 1 to 2 weeks, see your doctor. If the affected area is very red and tender, see your doctor sooner. "
ELSE NOT Do you have a moist white area of peeling skin and itching between toes and scaling

RULE R34
IF NOT Do you have a moist white area of peeling skin and itching between toes and scaling THEN
 ASK Do you have a burning pain at the base of a toe on the bottom of u foot along with tingling

RULE R35
IF Do you have a burning pain at the base of a toe on the bottom of u foot along with tingling = TRUE
AND NOT Do you have a moist white area of peeling skin and itching between toes and scaling THEN
text OF diagnosis textbox := " You may have MORTON'S NEUROMA, a noncencerous growth of nerve tissue. "
AND text OF recommend textbox :="Wear wide shoes with soft insoles. Over-the-counter anti-inflammatory medication or ice massages may help relieve the pain."
ELSE NOT Do you have a burning pain at the base of a toe on the bottom of u foot along with tingling

RULE R36
IF NOT Do you have a burning pain at the base of a toe on the bottom of u foot along with tingling
THEN ASK Is a part of your foot red swollen warm and tender

RULE R37
IF Is a part of your foot red swollen warm and tender = TRUE
AND NOT Do you have a burning pain at the base of a toe on the bottom of u foot along with tingling
THEN text OF diagnosis textbox := " You may have an infection called CELLULITIS.
 If you have diabetes, an infection of your foot may be more common and more dangerous. "
AND text OF recommend textbox := " URGENT See your doctor promptly. Cellulitis is usually treated with antibiotics."
ELSE NOT Is a part of your foot red swollen warm and tender

RULE R38
IF NOT Is a part of your foot red swollen warm and tender
THEN ASK Have your toes been exposed to very cold temperatures

RULE R39
IF Have your toes been exposed to very cold temperatures = TRUE
AND NOT Is a part of your foot red swollen warm and tender
THEN text OF diagnosis textbox := " FROSTBITE may damage your skin and tissues. "
AND text OF recommend textbox := " URGENT See your doctor. Warm the feet by immersing them in warm (not hot) water or by applying warm cloths to the affected area. "
ELSE NOT Have your toes been exposed to very cold temperatures

RULE R40
 IF NOT Have your toes been exposed to very cold temperatures
THEN ASK Have you lost sensation in your toes or are they discolored and foul smelling

RULE R41
IF Have you lost sensation in your toes or are they discolored and foul smelling = TRUE
AND NOT Have your toes been exposed to very cold temperatures
THEN text OF diagnosis textbox := " GANGRENE can occur if a body part loses its blood supply because of diabetes or hardening of the arteries "
AND text OF recommend textbox := "URGENT See your doctor. Good diabetic foot care may prevent some infections that could lead to gangrene and loss of toes."
ELSE NOT Have you lost sensation in your toes or are they discolored and foul smelling

RULE R42
IF NOT Have you lost sensation in your toes or are they discolored and foul smelling
THEN text OF diagnosis textbox := " For more information, please talk to your doctor. If you think the problem is serious, call your doctor right away. "
AND text OF recommend textbox := " "
END

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