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A Proposed Expert System for Obstetrics & Gynecology Diseases Diagnosis

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***Abstract**: **Background:** Obstetrics and gynaecology are many and common, where a woman suffers from problems related to pregnancy or her reproductive organs. Any part of her body may be affected due to some symptoms that are completely related to the reproductive organs when she is in a critical period for her, whether in her menstrual cycle, pregnancy, or disease conditions. The bulk of cases of diseases related to women and childbirth are dealt with great care and special care, as all diseases related to women are considered very sensitive diseases due to the presence of the disease in sensitive and not simple places. A gynaecologist is a specialist in all diseases and problems related to the female sexual organs. They perform regular preventive medical exams, such as cervical smear tests and breast exams. It also provides consultations for women of all ages about the problems of contraception, infertility and menopause. **Objectives**: The objective of this expert system is to help and facilitate women in diagnosing diseases related to their obstetrics and gynaecology, a simple expert system has been designed consisting of ten various common diseases that affect women whether During or without pregnancy, **Methods**: In this system, the system consists of a list of some common symptoms, the correct diagnosis adopted for these diseases, and how to treat diseases in the correct way with the help of a consultant obstetrician and gynaecologist, Dr. Fathi Muhammad Al-Habibi, and these diseases are: uterine cancer, cervical cancer, Infertility, double uterus, ectopic pregnancy, endometrial cancer, female sexual dysfunction, endometriosis, faecal incontinence, female infertility, CLIPS Expert System language was used to design and implement the proposed expert system. **Results**: The proposed ten obstetrics and gynaecology diagnostic expert system was evaluated by medical students and they were satisfied with its performance. **Conclusions**: The proposed expert system is very useful for obstetricians and gynaecologists, patients with reproductive system problems, and recent graduates.*

Keywords: Expert Systems, CLIPS, Obstetrics and Gynaecology diseases.

INTRODUCTION

The uterus is a reproductive organ in most mammals, including humans. In humans, the uterus is a hollow, muscular organ with a thick wall that connects from the top to the fallopian tubes. The uterus resembles an inverted pear in shape and size. Its length is about 7 cm and its width is about 5 cm. The uterus expands during pregnancy and doubles 22 times from 50 grams before conception to 1100 grams at birth to accommodate the fetus growing inside it. The body wall of the uterus consists of three layers: the uterine epithelium, the myometrium, the endometrium, and the components of the uterus: corpus uteri, isthmus uteri, cervix uteri [1].

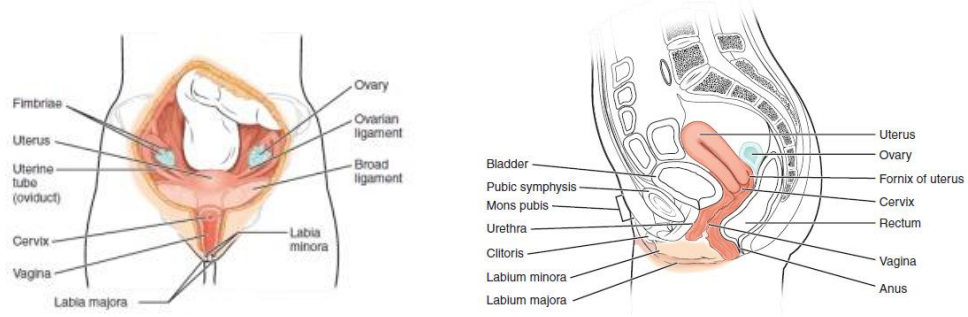

Figure 1 Uterus

The uterus is the place where the fetus grows during pregnancy, and the uterus may be exposed to a number of problems and diseases that cause some initial symptoms in women; Such as: bleeding between menstrual cycles or after intercourse, and uterine diseases arise from a number of reasons; Such as: hormones, thyroid problems, uterine fibroids, uterine polyps, cancer, infection, or pregnancy. The uterus may be exposed to problems that affect the tissues lining the uterus and grow in other than the place designated for them, as in the cases of endometriosis and adenomyosis. Treatment methods vary according to the underlying cause of the disease;

Contraceptive pills treat hormonal imbalances in some cases, and treating thyroid disorders may contribute to stopping bleeding when they cause bleeding, and some women may resort to surgery when they have cancer or hyperplasia, which is an excessive growth of normal cells in the uterus [2] [1].

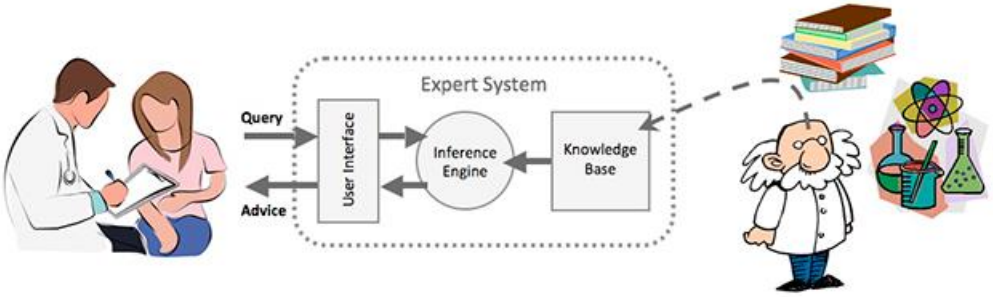

Figure 2 : Medical Expert System

The expert system specialized in the diagnosis and treatment of obstetrics and gynaecology is designed in a smooth and simple way, starting with the user interface and often this user is not an expert. The system is designed by CLIPS language and the Delphi Embarcadero RAD Studio XE6. It's easy for the knowledge engineer to build the Expert System and for the end users when they use the system.

MATERIAL AND METHODS

The intended expert system diagnoses ten "initial" diseases of obstetrics and gynaecology related to women, whether during pregnancy or not during pregnancy. At the beginning, the system provides a simple overview of the system in general. As in Figure 3 below

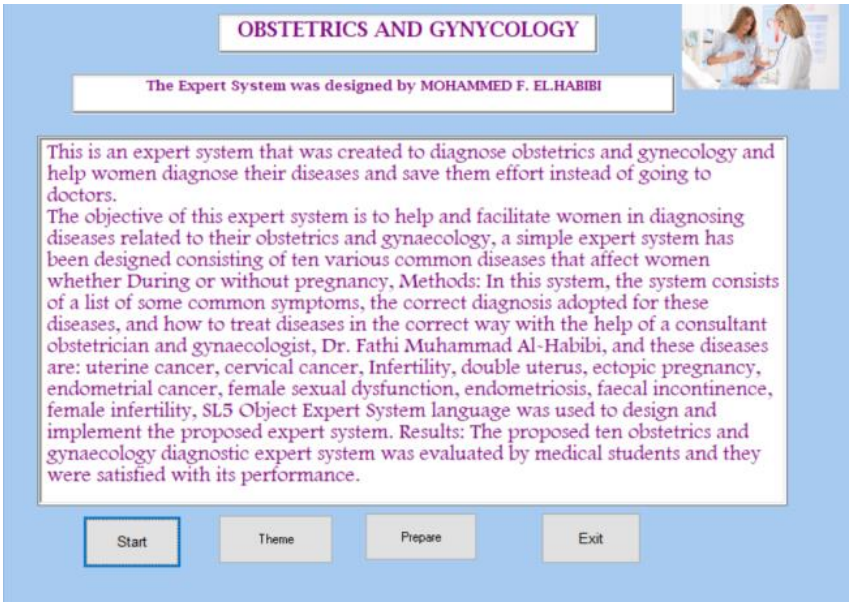

Figure 3 User Interface

When clicking on the "Start" icon, the user will be directed to an interface consisting of a set of symptoms arranged alphabetically in order to facilitate the user in using the system as can be seen in Figure 4.

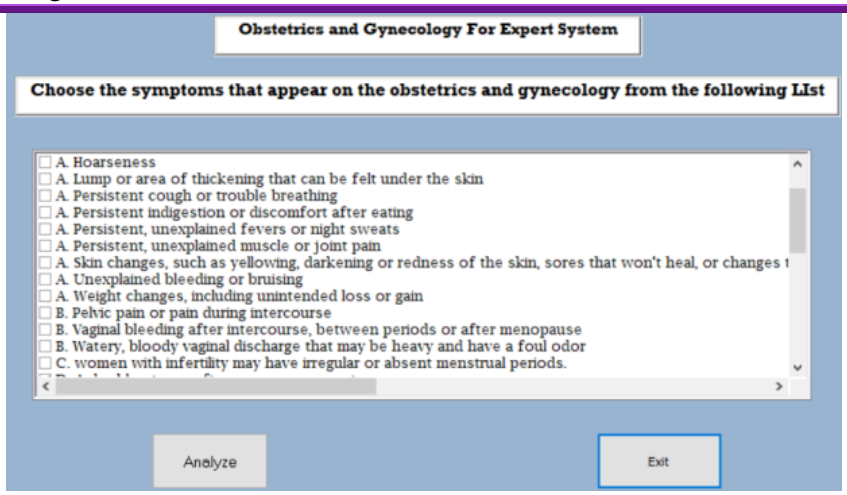

Figure 4: The symptoms that will appear

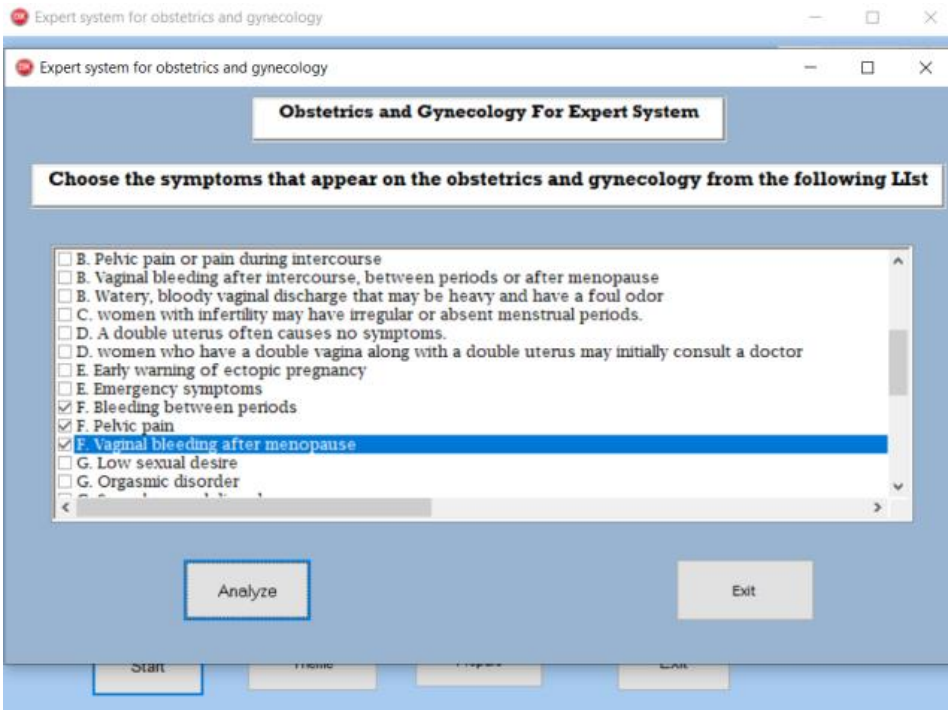

Figure 5: The symptoms to choose

After that, the patient will choose the symptoms from the list attached to the picture below, and these symptoms are arranged alphabetically initially to facilitate the patient's diagnosis process.

After selecting the patient's symptoms, the patient will click on "Analysis" to go to the new interface for the analysis process, and this interface consists of the name of the disease, the common diagnosis, and the common treatment, then a picture of this disease is attached with its data.

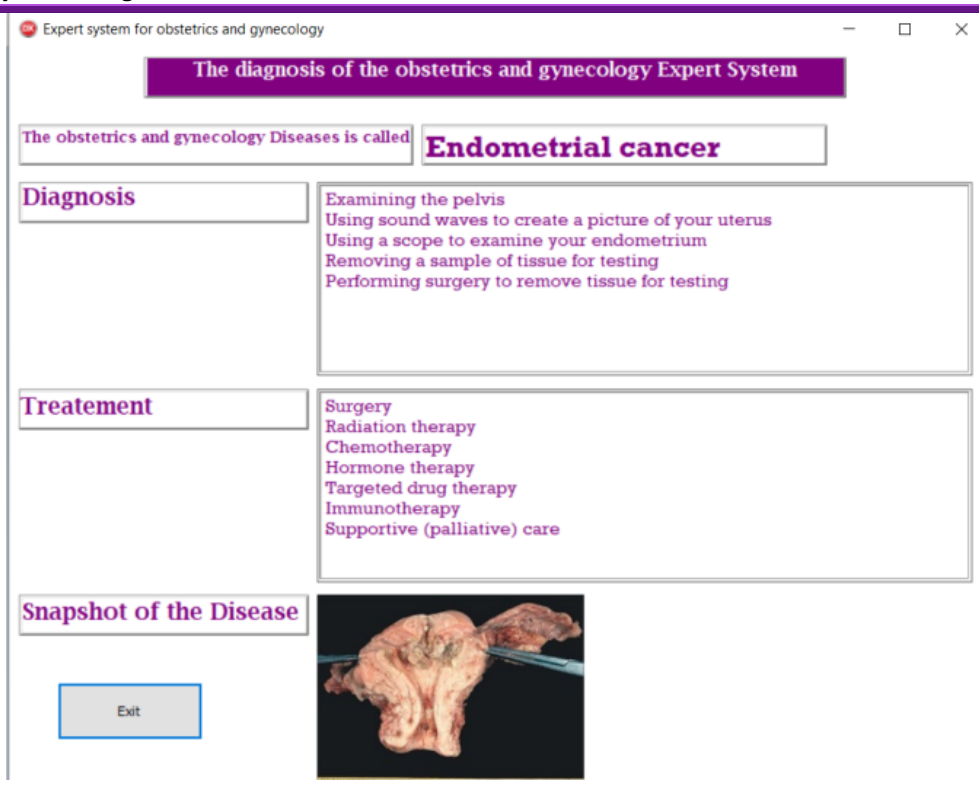

Figure 6: The Diagnosis Interface

LITERATURE REVIEW

There are many expert systems developed in agriculture [8-31] like: papaya plant disease diagnosis, grapes diagnosis and treatment, onion rule based system for disorders diagnosis and treatment, diagnosing tobacco diseases, banana knowledge based system diagnosis and treatment, spinach expert system: diseases and symptoms, knowledge based system for apple problems using clips, diagnosing banana disorders, black pepper expert system, knowledge based system for diagnosing guava problems, an expert system for citrus diseases diagnosis, expert system for sesame diseases diagnosis, expert system for the diagnosis of mango diseases, expert system for diagnosing sugarcane diseases, expert system for the diagnosis of wheat diseases, coffee diseases, diagnosing and treating potatoes problems, safflower disease diagnosis and treatment, castor diseases and diagnosis, coconut diseases diagnosis, plant disease diagnosis, and apple trees.

There are many expert systems implemented for educations [32-34], like: guiding freshman students in selecting a major in Al-Azhar University, selecting exploratory factor analysis procedures, calculating inheritance in Islam. In general health [35-71] like: anemia expert system diagnosis, diagnosing coronavirus (covid-19), short-term abdominal pain (stomach pain) diagnosis and treatment, diagnosing breast cancer, diagnosing skin cancer , ankle problems, hip problems, hair loss diagnosis, chest pain in infants and children, diagnosis of dengue disease, high blood pressure, ankle diseases, thyroid problems, problems of teeth and gums, diagnosing cough problem, lower back pain, rickets diagnoses and treatment, neck pain diagnosis, diagnosing facial-swelling, throat problems, kidney, depression diagnosis, diabetes diagnosis, polymyalgia rheumatic, silicosis, endocrine diagnosis and treatments, arthritis diseases diagnosis, hepatitis, diagnosis of seventh nerve inflammation (bell's palsy) disease, knee problems diagnosis, and uveitis disease diagnosis. In control [75-76,] like: modeling and controlling smart traffic light system. In maintenance [72-74], like: photo copier maintenance, desktop pc troubleshooting, and diagnosing wireless connection problems.

Comments about previous studies

There are many expert systems in obstetrics and gynaecology and a lot of articles**,** research and journals, but in the process of researching I did not find any effective expert system that actually works. There may be systems operating in this area, and if they are found, they may be paid systems or offered for sale. Al-Habibi was developed as a practical start for diagnosing ten common diseases in this field, and this process will help the woman diagnose herself in the correct and safe way based on the common

diagnosis and treatment in the usual medical life, with reservations and never underestimate the diagnosis associated with the patient's going to the doctor.

KNOWLEDGE REPRESENTATION

The main sources of knowledge for this expert system were resorted to by relying on two reliable sources, an electronic source, and a human source, a consultant physician in obstetrics, gynaecology and infertility, and these ten diseases are [1-7]:

1) Cancer

Cancer refers to any one of a large number of diseases characterized by the development of abnormal cells that divide uncontrollably and have the ability to infiltrate and destroy normal body tissue. Cancer often has the ability to spread throughout your body. Cancer is the second-leading cause of death in the world. But survival rates are improving for many types of cancer, thanks to improvements in cancer screening, treatment and prevention**.**

Causes: Cancer is caused by changes (mutations) to the DNA within cells. The DNA inside a cell is packaged into a large number of individual genes, each of which contains a set of instructions telling the cell what functions to perform, as well as how to grow and divide. Errors in the instructions can cause the cell to stop its normal function and may allow a cell to become cancerous.

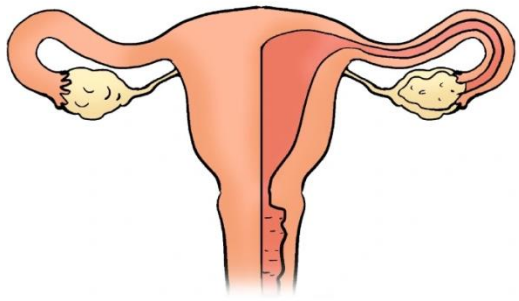

Figure 7: Gene mutations that cause jump

Mutations happen often. A mutation may be beneficial, harmful, or neutral. This depends where in the gene the change occurs. Typically, the body corrects most mutations. A single mutation will likely not cause cancer. Usually, cancer occurs from multiple mutations over a lifetime. That is why cancer occurs more often in older people. They have had more opportunities for mutations to build up [7]**.**

Types of genes linked to cancer

Many of the genes that contribute to cancer development fall into broad categories:

Tumor suppressor genes. These are protective genes. Normally, they limit cell growth by:

Monitoring how quickly cells divide into new cells

Repairing mismatched DNA

Controlling when a cell dies

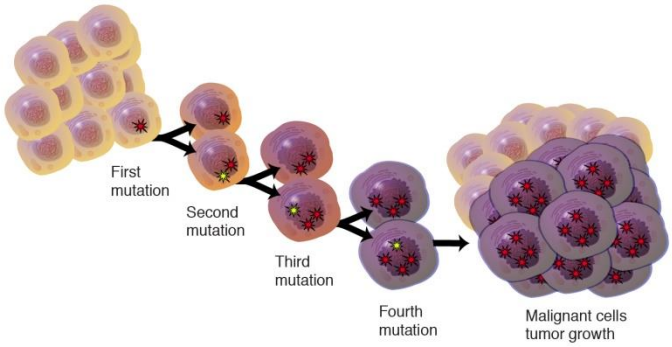

Figure 7: mutations and cancer

When a tumor suppressor gene mutates, cells grow uncontrollably. And they may eventually form a tumor.

Examples of tumor suppressor genes include BRCA1, BRCA2, and p53 or TP53. Germline mutations in BRCA1 or BRCA2 genes increase a woman's risk of developing hereditary breast or ovarian cancers and a man's risk of developing hereditary prostate or breast cancers. They also increase the risk of pancreatic cancer and melanoma in women and men. The most commonly mutated gene in people with cancer is p53 or TP53. More than 50% of cancers involve a missing or damaged p53 gene. Most p53 gene mutations are acquired. Germline p53 mutations are rare, but patients who carry them are at a higher risk of developing many different types of cancer [7]**.**

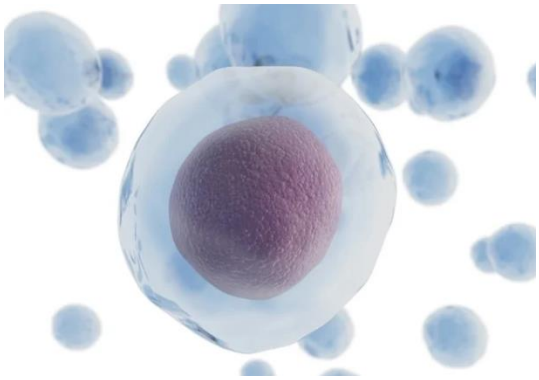

Figure 8: tumor suppressor genes

Two common oncogenes are:

HER2, a specialized protein that controls cancer growth and spread. It is found in some cancer cells. For example, breast and ovarian cancer cells. The RAS family of genes, which makes proteins involved in cell communication pathways, cell growth, and cell death. DNA repair genes. These fix mistakes made when DNA is copied. Many of them function as tumor suppressor genes. BRCA1, BRCA2, and p53 are all DNA repair genes. If a person has an error in a DNA repair gene, mistakes remain uncorrected. Then, the mistakes become mutations. These mutations may eventually lead to cancer, particularly mutations in tumor suppressor genes or oncogenes. Mutations in DNA repair genes may be inherited or acquired. Lynch syndrome is an example of the inherited kind. BRCA1, BRCA2, and p53 mutations and their associated syndromes are also inherited [7]**.**

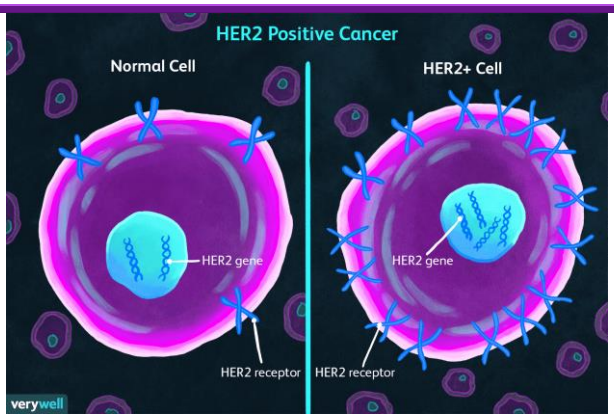

Figure 9: HER2 Testing in Breast Cancer

Cervical cancer

Cervical cancer is a type of cancer that occurs in the cells of the cervix — the lower part of the uterus that connects to the vagina. Various strains of the human papillomavirus (HPV), a sexually transmitted infection, play a role in causing most cervical cancer. When exposed to HPV, the body's immune system typically prevents the virus from doing harm. In a small percentage of people, however, the virus survives for years, contributing to the process that causes some cervical cells to become cancer cells. You can reduce your risk of developing cervical cancer by having screening tests and receiving a vaccine that protects against HPV infection **[5].**

Causes: Cervical cancer begins when healthy cells in the cervix develop changes (mutations) in their DNA. A cell's DNA contains the instructions that tell a cell what to do. Healthy cells grow and multiply at a set rate, eventually dying at a set time. The mutations tell the cells to grow and multiply out of control, and they don't die. The accumulating abnormal cells form a mass (tumor). Cancer cells invade nearby tissues and can break off from a tumor to spread (metastasize) elsewhere in the body. It isn't clear what causes cervical cancer, but it's certain that HPV plays a role. HPV is very common, and most people with the virus never develop cancer. This means other factors — such as your environment or your lifestyle choices — also determine whether you'll develop cervical cancer **[5].**

Types of cervical cancer

The type of cervical cancer that you have helps determine your prognosis and treatment. The main types of cervical cancer are:

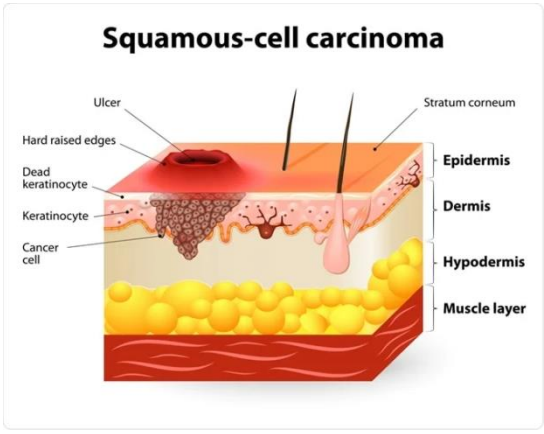

Figure 10: Squamous cell carcinoma

This type of cervical cancer begins in the thin, flat cells (squamous cells) lining the outer part of the cervix, which projects into the vagina. Most cervical cancers are squamous cell carcinomas [5].

Adenocarcinoma. This type of cervical cancer begins in the column-shaped glandular cells that line the cervical canal.

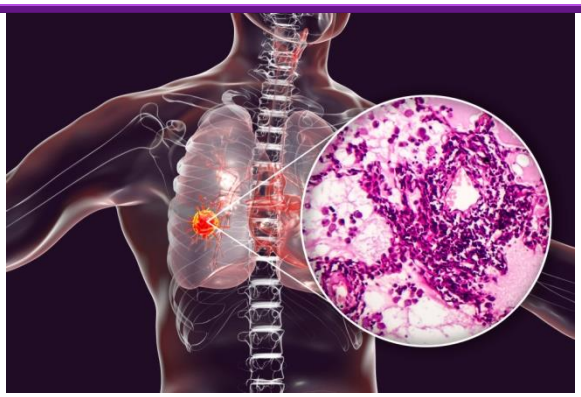

Figure 11: Adenocarcinoma

Risk factors

Risk factors for cervical cancer include:

Many sexual partners. The greater your number of sexual partners — and the greater your partner's number of sexual partners — the greater your chance of acquiring HPV.

Early sexual activity. Having sex at an early age increases your risk of HPV. Other sexually transmitted infections (STIs). Having other STIs — such as chlamydia, gonorrhea, syphilis and HIV/AIDS — increases your risk of HPV.A weakened immune system. You may be more likely to develop cervical cancer if your immune system is weakened by another health condition and you have HPV. Smoking. Smoking is associated with squamous cell cervical cancer. Exposure to miscarriage prevention drug. If your mother took a drug called diethylstilbestrol (DES) while pregnant in the 1950s, you may have an increased risk of a certain type of cervical cancer called clear cell adenocarcinoma **[5].**

Prevention

To reduce your risk of cervical cancer:

Ask your doctor about the HPV vaccine. Receiving a vaccination to prevent HPV infection may reduce your risk of cervical cancer and other HPV-related cancers. Ask your doctor whether an HPV vaccine is appropriate for you. Have routine Pap tests. Pap tests can detect precancerous conditions of the cervix, so they can be monitored or treated in order to prevent cervical cancer. Most medical organizations suggest beginning routine Pap tests at age 21 and repeating them every few years. Practice safe sex. Reduce your risk of cervical cancer by taking measures to prevent sexually transmitted infections, such as using a condom every time you have sex and limiting the number of sexual partners you have. Don't smoke. If you don't smoke, don't start. If you do smoke, talk to your doctor about strategies to help you quit [5].

2) Infertility

If you and your partner are struggling to have a baby, you're not alone. In the United States, 10% to 15% of couples are infertile. Infertility is defined as not being able to get pregnant despite having frequent, unprotected sex for at least a year for most couples. Infertility may result from an issue with either you or your partner, or a combination of factors that prevent pregnancy. Fortunately, there are many safe and effective therapies that significantly improve your chances of getting pregnant [9]**.**

Figure 12: pregnancy test

Causes

All of the steps during ovulation and fertilization need to happen correctly in order to get pregnant. Sometimes the issues that cause infertility in couples are present at birth, and sometimes they develop later in life. Infertility causes can affect one or both partners. Sometimes, no cause can be found [6].

Causes of female infertility may include:

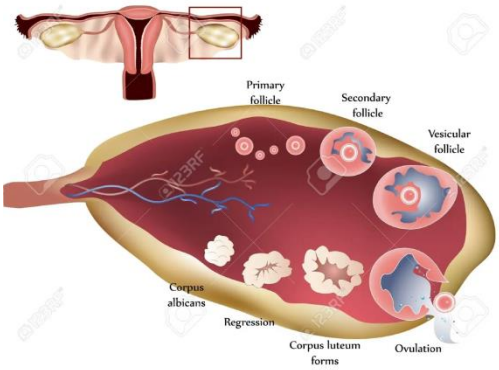

Figure 13: Ovulation disorders

Ovulation disorders, which affect the release of eggs from the ovaries. These include hormonal disorders such as polycystic ovary syndrome. Hyperprolactinemia, a condition in which you have too much prolactin — the hormone that stimulates breast milk production also may interfere with ovulation. Either too much thyroid hormone (hyperthyroidism) or too little can affect the menstrual cycle or cause infertility. Other underlying causes may include too much exercise, eating disorders or tumors[6].

Uterine or cervical abnormalities, including abnormalities with the cervix, polyps in the uterus or the shape of the uterus. Noncancerous (benign) tumors in the uterine wall (uterine fibroids) may cause infertility by blocking the fallopian tubes or stopping a fertilized egg from implanting in the uterus.

Fallopian tube damage or blockage, often caused by inflammation of the fallopian tube (salpingitis). This can result from pelvic inflammatory disease, which is usually caused by a sexually transmitted infection, endometriosis or adhesions.

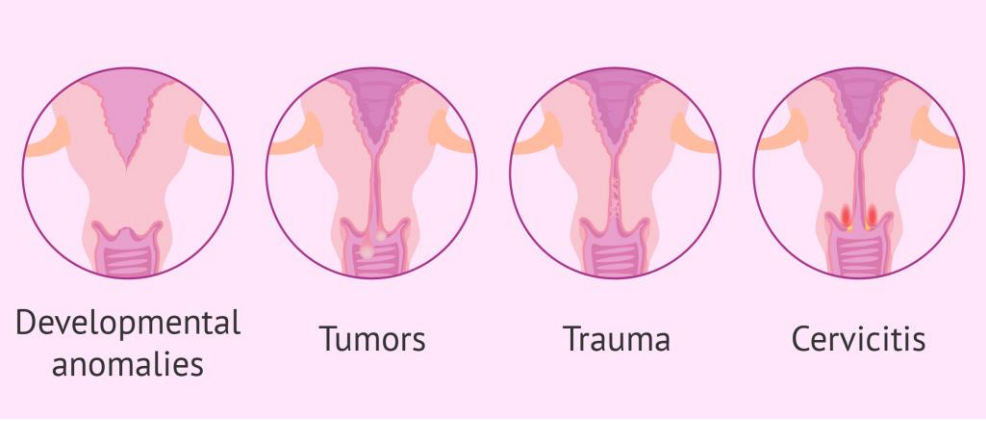

Figure 14: Cervical factor female

Endometriosis, which occurs when endometrial tissue grows outside of the uterus, may affect the function of the ovaries, uterus and fallopian tubes.

Primary ovarian insufficiency (early menopause), when the ovaries stop working and menstruation ends before age 40. Although the cause is often unknown, certain factors are associated with early menopause, including immune system diseases, certain genetic conditions such as Turner syndrome or carriers of Fragile X syndrome, and radiation or chemotherapy treatment **[6]**.

Pelvic adhesions, bands of scar tissue that bind organs that can form after pelvic infection, appendicitis, endometriosis or abdominal or pelvic surgery. Cancer and its treatment. Certain cancers — particularly reproductive cancers — often impair female fertility. Both radiation and chemotherapy may affect fertility **[6]**.

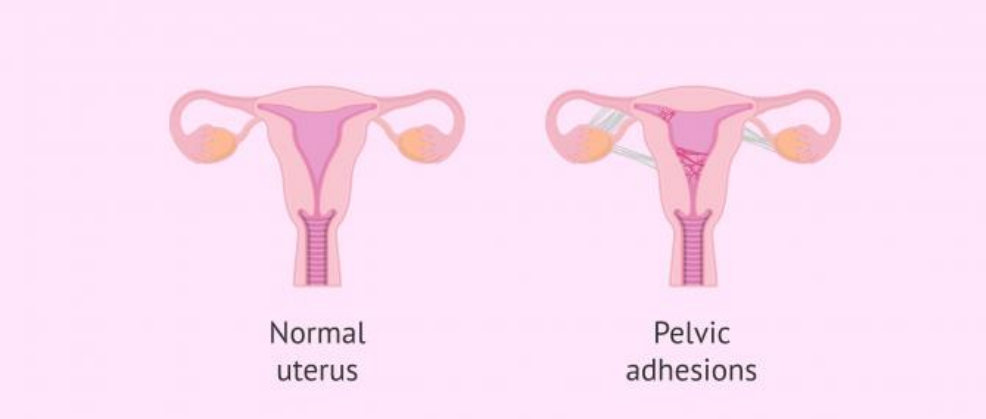

Figure 15: Pelvic adhesions

3) Double uterus

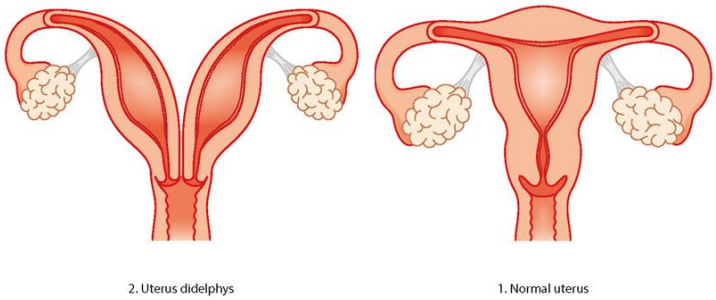

Figure 16: Double uterus

A double uterus is a rare congenital abnormality. In a female fetus, the uterus starts out as two small tubes. As the fetus develops, the tubes normally join to create one larger, hollow organ — the uterus. Sometimes, however, the tubes don't join completely. Instead, each one develops into a separate structure. A double uterus may have one opening (cervix) into one vagina, or each uterine cavity may have a cervix. In many cases, a thin wall of tissue runs down the length of the vagina, dividing it into two separate openings. Women who have a double uterus often have successful pregnancies. But the condition can increase the risk of miscarriage or premature birth **[7].**

4) Ectopic pregnancy

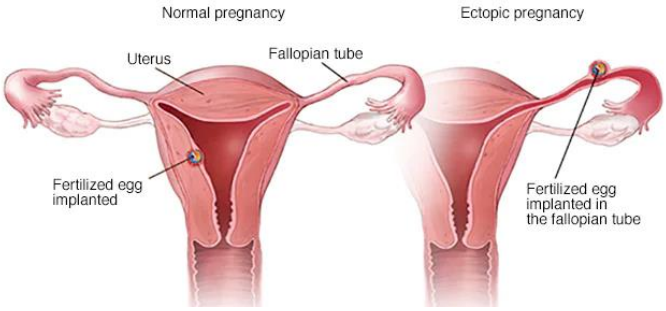

Figure 17: Ectopic pregnancy

Pregnancy begins with a fertilized egg. Normally, the fertilized egg attaches to the lining of the uterus. An ectopic pregnancy occurs when a fertilized egg implants and grows outside the main cavity of the uterus. An ectopic pregnancy most often occurs in a fallopian tube, which carries eggs from the ovaries to the uterus. This type of ectopic pregnancy is called a tubal pregnancy. Sometimes, an ectopic pregnancy occurs in other areas of the body, such as the ovary, abdominal cavity or the lower part of the uterus (cervix), which connects to the vagina. An ectopic pregnancy can't proceed normally. The fertilized egg can't survive, and the growing tissue may cause life-threatening bleeding, if left untreated **[7].**

5) Endometrial cancer

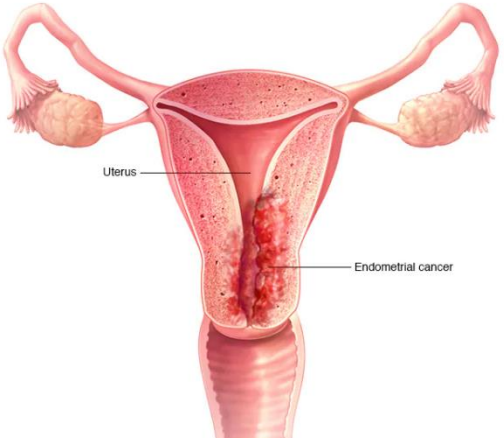

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Figure 18: Endometrial cancer

is a type of cancer that begins in the uterus. The uterus is the hollow, pear-shaped pelvic organ where fetal development occurs. Endometrial cancer begins in the layer of cells that form the lining (endometrium) of the uterus. Endometrial cancer is sometimes called uterine cancer. Other types of cancer can form in the uterus, including uterine sarcoma, but they are much less common than endometrial cancer. Endometrial cancer is often detected at an early stage because it frequently produces abnormal vaginal bleeding. If endometrial cancer is discovered early, removing the uterus surgically often cures endometrial cancer [4]**.**

6) Female sexual dysfunction

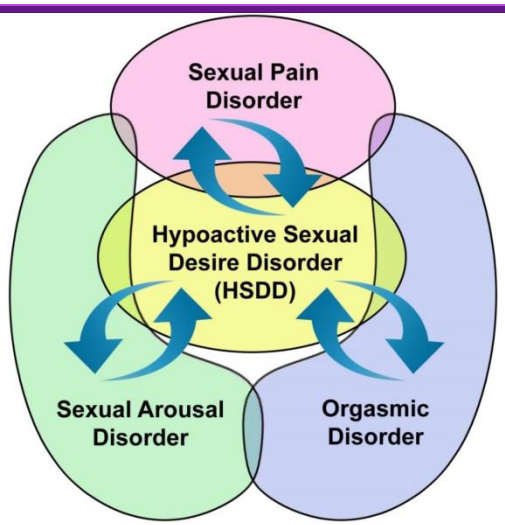

Figure 19: Female sexual dysfunction 1

Persistent, recurrent problems with sexual response, desire, orgasm or pain — that distress you or strain your relationship with your partner — are known medically as sexual dysfunction. Many women experience problems with sexual function at some point, and some have difficulties throughout their lives. Female sexual dysfunction can occur at any stage of life. It can occur only in certain sexual situations or in all sexual situations. Sexual response involves a complex interplay of physiology, emotions, experiences, beliefs, lifestyle and relationships. Disruption of any component can affect sexual desire, arousal or satisfaction, and treatment often involves more than one approach [4].

Risk factors

Some factors may increase your risk of sexual dysfunction:

Depression or anxiety, Heart and blood vessel disease, Neurological conditions, such as spinal cord injury or multiple sclerosis ,Gynaecological conditions, such as vulvovaginal atrophy, infections or lichen sclerosus ,Certain medications, such as antidepressants or high blood pressure medications ,Emotional or psychological stress, especially with regard to your relationship with your partner ,A history of sexual abuse [7].

7) Endometriosis

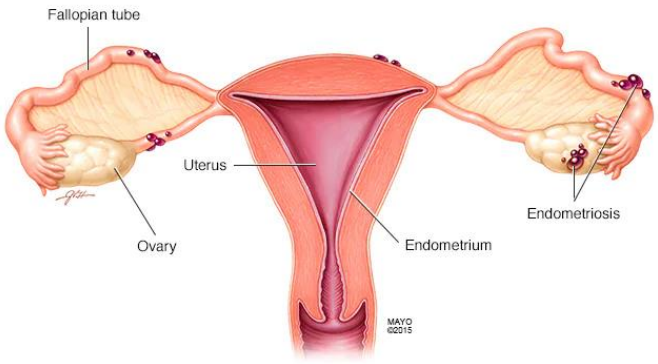

Figure 20: Endometriosis

Endometriosis (en-doe-me-tree-O-sis) is an often painful disorder in which tissue similar to the tissue that normally lines the inside of your uterus — the endometrium — grows outside your uterus. Endometriosis most commonly involves your ovaries, fallopian tubes and the tissue lining your pelvis. Rarely, endometrial-like tissue may be found beyond the area where pelvic organs are located. With endometriosis, the endometrial-like tissue acts as endometrial tissue would — it thickens, breaks down and bleeds with each menstrual cycle. But because this tissue has no way to exit your body, it becomes trapped. When endometriosis involves the ovaries,

cysts called endometrioses may form. Surrounding tissue can become irritated, eventually developing scar tissue and adhesions — bands of fibrous tissue that can cause pelvic tissues and organs to stick to each other. Endometriosis can cause pain — sometimes severe — especially during menstrual periods. Fertility problems also may develop. Fortunately, effective treatments are available [5].

Surrounding tissue can become irritated, eventually developing scar tissue and adhesions — bands of fibrous tissue that can cause pelvic tissues and organs to stick to each other. Endometriosis can cause pain — sometimes severe — especially during menstrual periods. Fertility problems also may develop [5].

8) Fecal incontinence

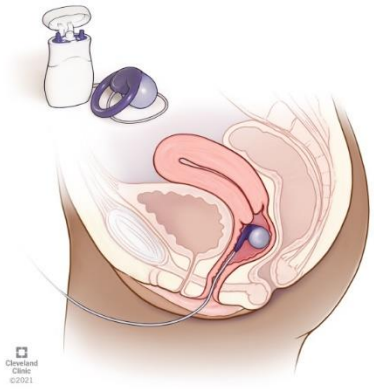

Figure 21: Fecal incontinence

Fecal incontinence is the inability to control bowel movements, causing stool (feces) to leak unexpectedly from the rectum. Also called bowel incontinence, fecal incontinence ranges from an occasional leakage of stool while passing gas to a complete loss of bowel control. Common causes of fecal incontinence include diarrhea, constipation, and muscle or nerve damage. The muscle or nerve damage may be associated with aging or with giving birth. Whatever the cause, fecal incontinence can be embarrassing. But don't shy away from talking to your doctor about this common problem. Treatments can improve fecal incontinence and your quality of life [8].

9) Female infertility

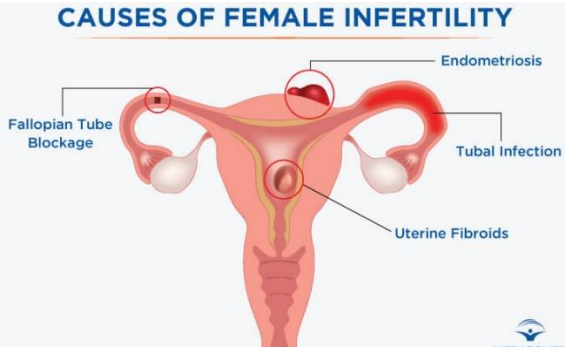

Figure 22: Female infertility

Infertility is defined as trying to get pregnant with frequent, unprotected sex for at least a year with no success. Infertility results from female factors about one-third of the time and both female and male factors about one-third of the time. The cause is either unknown or a combination of male and female factors in the remaining cases. Female infertility causes can be difficult to diagnose. There are many treatments, depending on the infertility cause. Many infertile couples will go on to conceive a child without treatment **[7]**.

LIMITATIONS

The expert system is only specialized in diagnosing ten diseases of women and childbirth, namely uterine cancer, cancer, infertility, double cervix, ectopic pregnancy, endometrial cancer, female sexual dysfunction, endometriosis, fecal incontinence, and female infertility. The number of diseases to be diagnosed.

SYSTEM EVALUATION

In principle, the system was tested and reviewed by a consultant obstetrician and gynecologist: Dr. Fathi Al-Habibi and found its effectiveness as a good initial start, without ever underestimating the extent of the expansion of diseases, symptoms, treatments and various diagnoses in obstetrics and gynaecology.

CONCLUSION

The expert system work to help and facilitate women in diagnosing diseases related to their obstetrics and gynaecology, a simple expert system has been designed consisting of ten various common diseases that affect women whether During or without pregnancy: In this system, the system consists of a list of some common symptoms, the correct diagnosis adopted for these diseases, and how to treat diseases in the correct way with the help of a consultant obstetrician.

FUTURE WORK

In the future, the number of diseases may be increased with greater accuracy in diagnosis and treatment. There is no doubt that the system is actually limited and may be unreliable, but as an actual start for diagnosing some common diseases in women in the field of obstetrics and gynaecology, it may be good and effective.

EXPERT SYSTEM SOURCE CODE

```
(defrule disease1
(A. Fatigue)a
(A. Lump or area of thickening that can be felt under the skin)
(A. Weight changes, including unintended loss or gain)
(A. Skin changes, such as yellowing, darkening or redness of the skin, sores that won't heal, or changes to existing moles)
(A. Changes in bowel or bladder habits)
(A. Persistent cough or trouble breathing)
(A. Changes in bowel or bladder habits)
(A. Difficulty swallowing)
(A. Hoarseness)
(A. Persistent indigestion or discomfort after eating)
(A. Persistent, unexplained muscle or joint pain)
(A. Unexplained bleeding or bruising)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "1"  crlf )
)
(defrule disease2
(B. Vaginal bleeding after intercourse, between periods or after menopause)
(B. Watery, bloody vaginal discharge that may be heavy and have a foul odor)
(B. Pelvic pain or pain during intercourse)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "2"  crlf )
)
(defrule disease3
(C. women with infertility may have irregular or absent menstrual periods.)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "3"  crlf )
```

```
)
(defrule disease4
(D. A double uterus often causes no symptoms.)
(D. women who have a double vagina along with a double uterus may initially consult a doctor)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "4"  crlf )
)
(defrule disease5
(E. Early warning of ectopic pregnancy)
(E. Emergency symptoms)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "5"  crlf )
)
(defrule disease6
(F. Vaginal bleeding after menopause)
(F. Bleeding between periods)
(F. Pelvic pain)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "6"  crlf )
)
(defrule disease7
(G. Low sexual desire)
(G. Sexual arousal disorder)
(G. Orgasmic disorder)
(G. Sexual pain disorder)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "7"  crlf )
)
(defrule disease8
(H. Painful periods (dysmenorrhea))
(H. Pain with intercourse)
(H. Pain with bowel movements or urination)
(H. Excessive bleeding)
(H. Infertility)
(H. Other signs and symptoms)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "8"  crlf )
)
(defrule disease9
(I. Diarrhea)
(I. Constipation)
(I. Gas and bloating)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "9"  crlf )
)
```

```
(defrule disease10
(J. The main symptom of infertility is the inability to get pregnant. A menstrual cycle that's too long (35 days or more), too short (less than 21 days), irregular or absent can mean that you're not ovulating. There might be no other signs or symptoms.)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "10"  crlf )
)
(defrule endline
(disease identified)
=>
  (close fdatao)
)
(defrule readdata
  (declare (salience 1000))
  (initial-fact)
  ?fx <- (initial-fact)
=>
  (retract ?fx)
  (open "data.txt" fdata "r")
  (open "result.txt" fdatao "w")
  (bind ?symptom1 (readline fdata))
  (bind ?symptom2 (readline fdata))
  (bind ?symptom3 (readline fdata))
  (bind ?symptom4 (readline fdata))
  (bind ?symptom5 (readline fdata))
  (bind ?symptom6 (readline fdata))
  (bind ?symptom7 (readline fdata))
  (bind ?symptom8 (readline fdata))
  (bind ?symptom9 (readline fdata))
  (bind ?symptom10 (readline fdata))

  (assert-string (str-cat "(" ?symptom1 ")"))
  (assert-string (str-cat "(" ?symptom2 ")"))
  (assert-string (str-cat "(" ?symptom3 ")"))
  (assert-string (str-cat "(" ?symptom4 ")"))
  (assert-string (str-cat "(" ?symptom5 ")"))
  (assert-string (str-cat "(" ?symptom6 ")"))
  (assert-string (str-cat "(" ?symptom7 ")"))
  (assert-string (str-cat "(" ?symptom8 ")"))
  (assert-string (str-cat "(" ?symptom9 ")"))
  (assert-string (str-cat "(" ?symptom10 ")"))
   (close fdata)
)
```

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