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REVIEW

Advantages of ultrasound as a diagnostic method in imaging

Ventajas de la ecografía como método diagnostico en imagenología

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ABSTRACT

Introduction: imaging plays a fundamental role in disease diagnosis. Healthcare professionals require tools to analyze the anatomical structures of the human body, and imaging methods range from the simplest to the most advanced. Ultrasound is one such method, allowing for high-quality diagnostic images. This study aims to recognize the advantages of ultrasound as a diagnostic imaging method for medical specialties in patient evaluation, providing efficient and timely information for treatment decisions.
Method: this article is a documentary review, using databases such as PubMed, Redalyc, and SciELO, among others. The keywords used were ultrasound, imaging, diagnosis, and health. The search yielded 48 articles, of which 21 considered for inclusion relevance to the topic.
Development: The research analyzes the advantages of ultrasound, its usefulness in detecting health problems and establishing treatment guidelines, by analyzing the information obtained in the collection of documents related to the topic.
Conclusion: imaging examinations are support methods for general practitioners and specialists in all areas of health. Ultrasound is a valuable diagnostic tool because it offers advantages in obtaining information about patients' health status quickly and efficiently.

Keywords: Imaging; Health; Utility; Professional.

RESUMEN

Introducción: la imagenología tiene un rol fundamental para el diagnóstico de enfermedades, los especialistas de la salud requieren herramientas para analizar las estructuras anatómicas del cuerpo humano, la imagenología tiene métodos que van desde los más simples, hasta los más sofisticados. La ecografía es un método que permite obtener imágenes diagnósticas de gran calidad. El estudio tiene como objetivo reconocer las ventajas de la ecografía como método diagnostico en imagenología, para las especialidades médicas, en la evaluación de los pacientes, para obtener información eficiente y oportuna, para la toma de decisiones sobre el tratamiento a seguir.
Método: el presente artículo es una revisión de tipo documental, obtenida en bases de datos como PubMed, Redalyc, SciELO, entre otros, las palabras clave utilizadas; ecografía, imagenología, diagnostico, salud, en la búsqueda se recolectaron 48 artículos y se consideraron 21 en la elaboración del artículo por estar relacionados al tema.
Desarrollo: la investigación analiza las ventajas de la ecografía, su utilidad para detectar problemas de salud y establecer las directrices del tratamiento, al analizar la información obtenida, en la recolección de documentos relacionaos al tema.
Conclusión: los exámenes Imagenológicos, son métodos de apoyo para médicos generales y especialistas en

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todas las áreas de salud. La ecografía es una herramienta de diagnóstico de gran valor por presentar ventajas a la hora de obtener información sobre el estado de salud de los pacientes en forma rápida y eficiente.

Palabras clave: Imagenología; Salud; Utilidad; Profesional.

INTRODUCTION

Imaging plays a fundamental role in the diagnosis of health problems. This medical specialty allows for the identification and monitoring of various pathologies that affect the population. Since the discovery of X-rays, a series of research processes have provided knowledge and tools to improve diagnostic processes. The scientific community and the general public have benefited from the properties of X-rays, as they have made it possible to observe the internal structures of the body. Imaging has various methods, some using ionizing radiation and others using non-ionizing radiation. Among the diagnostic imaging methods recognized are computed tomography, magnetic resonance imaging, bone densitometry, scintigraphy, ultrasound, conventional radiology, and digital radiology, among others. Radiology has traditionally been the first method of choice for evaluating and confirming or ruling out cracks or fractures in bone structures, and in situations such as trauma caused by workplace accidents, car accidents, among others. Conventional radiology was widely used from the outset, followed by the emergence of digital radiology at the end of the 20th century, which now allows for more efficient diagnosis and information sharing. In order to correctly interpret the findings in images, it is important to understand the anatomy, physiology, and pathologies of injuries.

Diagnostic imaging involves performing tests to confirm or rule out a condition or injury that is affecting the patient's health to a greater or lesser degree. Ultrasound has become an essential tool in daily clinical practice as it increases diagnostic efficiency and reduces uncertainty. Its development has led to significant advances in emergency care by providing real-time information that facilitates decision-making in critical situations.[1] Meanwhile, Vallejo. A. states that the usefulness of diagnostic imaging depends on its proper use, recognizing the value of each imaging exam on pathologies and anatomical structures for proper interpretation and correct diagnosis.[2]

Ultrasound is a diagnostic imaging method that allows the interior of the body to be observed and evaluations to be carried out that are economical, rapid, and accessible to the public, obtaining high-quality images. It is the method of choice for the study of a variety of organs.

The purpose of this article is to recognize the advantages of ultrasound as a diagnostic imaging method for medical specialties in the evaluation of patients, in order to obtain efficient and timely information for decision-making regarding the treatment to be followed.

METHOD

The methodology used for this research work is a documentary review, focused on highlighting the advantages, importance, and usefulness of ultrasound as a diagnostic method in imaging. The study is based on a bibliographic compilation of electronic sources obtained from databases such as Pub. Med, Redalyc, Scielo, among others. The keywords used for the search are related to the specialty area of imaging, including the following words: The search yielded 48 articles, from which the most relevant to the topic were selected, considering those whose theoretical content reported on the advantages and usefulness of the ultrasound method, giving priority to references that related it to medical specialties and provided relevant information for this article. After conducting an analysis, 21 were considered, and based on their content, this paper was written.

DEVELOPMENT

Currently, there is a need for efficient diagnostic methods that are fast and timely. Within the healthcare team, there are professionals who need to detect health problems in order to establish treatment guidelines.

Imaging tests are support methods for general practitioners and specialists in all medical fields, allowing them to observe and analyze a patient's pathologies. The procedures range from the simplest to the most sophisticated, providing static and moving images that are an invaluable resource in medical studies.[3]

Ultrasound is an imaging method that uses high-frequency sound waves on a body or object to obtain data that is recorded on a computer and processed to create images of the organs being studied. It offers excellent advantages for determining the health status of patients in a variety of situations. The word ultrasound comes from the Greek "ἠχώ" ēkhō="echo," and "γραφία" graphia = "writing," which means writing echoes.

The equipment used to perform these examinations are ultrasound machines, which have a mechanism that reflects the echoes of anatomical structures, providing body images thanks to the interaction between the ultrasonic wave pulses and the medium. Ultrasound has a frequency that exceeds the sound audible to humans,

which is approximately 20 000 Hertz. To produce an image, a frequency between 2 and 10 million Hertz is used.

Ultrasound imaging is a method that reconstructs images from temporal data using specialized software integrated into the ultrasound equipment. The images obtained are reviewed by a specialist, who analyzes them together with the patient's medical history and laboratory tests. According to Osiniri Kippes: Performing a direct examination with a correct clinical evaluation is key to the diagnostic process.[4]

Among the many pathological problems that can affect patients' health are vascular problems, including lower limb CVI, which is a consequence of increased venous pressure due to valve incompetence and venous obstruction. To diagnose this health problem, clinical findings are used as a reference and an ultrasound method called Doppler ultrasound is applied, which provides very useful information for locating the lesion and determining its severity.[5]

Ultrasound is a very useful method in emergencies such as appendicitis, or in the presence of colic due to kidney stones, or to determine if there are liver stones, or in cases of pancreatitis. It is also very useful for examining the prostate, ovaries, or uterus, and is a widely used test in the medical world. Sound waves create echoes that form images on a computer screen based on anatomical structures, obtaining diagnostic images from the echoes obtained by the emission of ultrasound waves.[6]

The information provided by ultrasound examinations is of great value to general practitioners and specialists alike. Gynecologists, obstetricians, endocrinologists, general practitioners, vascular surgeons, orthopedic surgeons, and physical therapists can all benefit from them. The images obtained in real time allow for a better understanding of patients' health conditions.

Currently, knowledge of diagnostic imaging techniques provides healthcare professionals with a complementary tool in their daily practice. These examinations should be requested after analyzing the usefulness and advantages of each modality. The physician is responsible for examining and diagnosing the patient. Establishing a good connection allows for the development of an emotional relationship with the patient.[7]

Ultrasound is a very useful technique in the field of health because it is safe and economical, fast, accurate, efficient, simple, non-invasive, painless, does not use ionizing radiation, and has high sensitivity and accuracy.

Relationship with medical specialties

Its effectiveness and advantages are of great value to various medical specialties in the diagnosis and monitoring of normal physiological processes and pathological situations, as well as helping to monitor various types of processes.

Abdominal ultrasound allows the organs of the abdomen, such as the liver, gallbladder, kidneys, pancreas, spleen, aorta, vena cava, portal vein, and hepatic vein, to be studied in order to assess their shape, size, edges, echogenicity, alterations, presence of fluid, tumors, h r cysts or stones, among others. In the study of the liver by abdominal ultrasound, a 3,5 MHz to 5 MHz multi-frequency convex transducer is used, with an acoustic coupler or gel to improve image quality.[8]

Abdominal ultrasounds are the most reliable and effective tool for detecting gallbladder lithiasis, and it is essential to measure the gallbladder and any abnormal content that is identified. In addition, it is necessary to determine whether there is hepatic steatosis, evidenced by fatty infiltration of the liver, which causes a diffuse increase in its echogenicity compared to the echogenicity of the kidneys. in any of its degrees and must identify whether there is enlargement of the liver and spleen (splenomegaly), characteristic conditions of this pathology when steatosis has reached grade 3, making the transition to liver cirrhosis almost inevitable, which is an almost impossible situation to reverse and does not have a good prognosis.

Nephrology is the medical specialty that studies the anatomy of the kidneys, and its functions focus on the prevention, diagnosis, and treatment of kidney diseases and their complications.

Abdominal ultrasound allows for screening of the entire abdomen. Ultrasound is an important tool in nephrology, allowing for a comprehensive and dynamic approach to patients with kidney disease in different clinical settings. Ultrasound performed by nephrologists can improve diagnosis by visualizing the internal anatomy of patients in real time, which is useful for detecting pathologies such as obstructive uropathy or venous congestion.[9]

The detection of lithiasis at the renal level, which can occur unilaterally or bilaterally, its presence and location reveals problems in the renal system. These stones can remain in the renal pelvis and, depending on their size, can cause obstruction of the pyelocaliceal system, leading to hydronephrosis. The retention of these waste fluids containing toxins causes health problems that can become serious and lead to renal failure if not treated and resolved in time. It should be noted that sometimes these stones can travel down the ureters and remain there, obstructing the elimination of urine and also causing colic.

The internist focuses on treating adult patients who do not require surgical intervention. They bring together the functions of different specialists and standardize patient treatment so that there are no harmful effects. In recent years, clinical ultrasound has established itself as an essential tool in the practice of internal medicine.

Its ability to provide immediate diagnostic information, without radiation and with a high degree of accuracy, has made this technology an indispensable complement to traditional physical examination.[10]

Among the pathologies or altered health conditions that these specialists can treat are problems that arise in the pancreas, which generate symptoms that the physician must evaluate and, if necessary, request additional tests, in addition to an abdominal ultrasound, considering that pancreatitis is one of the most important health problems due to the serious complications involved in not detecting it in time.

The normal liver has a homogeneous echo structure (similar to that of the spleen and somewhat larger than the kidney cortex). Small round or linear anechoic areas corresponding to the veins can be seen inside.[11]

Another common condition that can be studied with ultrasound is hepatic steatosis. Fat deposits detected by abdominal ultrasound in hepatocytes reveal varying degrees of inflammation and fibrosis as a refractive image. This method allows for early detection in the entire population. Detecting it in time allows for the application of preventive measures to keep the liver in the best possible condition, avoiding complications such as cirrhosis, which can lead to death if not detected and treated in time.[12]

Ultrasound is highly sensitive to the presence of moderate or severe fat (grade II or III). Its predictive value is 92 % based on the degree of steatosis, inflammation, and fibrosis.

It is important to emphasize that in all the cases mentioned, the incidental finding of masses, tumors, or other types of pathology concomitant with the previously suspected condition cannot be ruled out.

Abdominal discomfort such as acute appendicitis presents nonspecific symptoms such as pain and diarrhea, which could lead to a misdiagnosis. The diagnosis is based primarily on clinical manifestations and physical examination, despite the availability of complementary tests that are useful for diagnosis.

Pelvic ultrasound is very useful for evaluating pathologies that occur in the pelvic area in most cases, problems with the reproductive system of both genders related to specialties such as gynecology, obstetrics, and urology.

Gynecology is the branch of medicine focused on the female reproductive system, providing care for all pathologies related to the uterus, vagina, and ovaries, including mammary glands, as well as disorders of the hormones that regulate its functioning. Obstetrics, meanwhile, is dedicated to the care of women during pregnancy and childbirth, and to the diagnosis and treatment of diseases of the female reproductive organs. In relation to these specialties, ultrasound allows for the evaluation of the health of the female reproductive system, monitoring of problems in the ovaries such as the presence of ovarian cysts, or problems of the cervix or uterus such as fibroids, masses, or tumors. It allows for the diagnosis of diseases of the mammary glands by confirming or ruling out the presence of lumps, cysts, or nodules that raise suspicion of tumors or cancer.

Ultrasound is a useful, safe, and informative imaging technique for evaluating female gynecological organs. It can be a useful first-line method for evaluating the uterus and diagnosing abnormalities, and it can also be used to evaluate the endometrium and adnexa in the context of menstrual disorders or abdominal pain. [13])

It is used to perform checks throughout the period of gestation from the beginning, evaluating the development of the fetus, gestational age, and vitality by monitoring the heartbeat, measuring the amniotic fluid, the maturity and location of the placenta, whether there is a congenital malformation, the umbilical cord, its position, and the probable date of delivery in the last trimester of pregnancy.[14]

In endocrinology, it is useful for studying the thyroid and mammary glands and is widely used to detect cysts, nodules, or tumors, which are among the most common pathologies. It also allows for analysis of patient progress during treatment. Linear transducers are used in these studies. The risk of malignancy of a thyroid nodule can be stratified based on ultrasound signs.[15]

In physical therapy, their scope of practice specializes in assisting with rehabilitation in the areas of sports, geriatrics, neurology, oncology, respiratory, and orthopedics. According to González: They are especially helpful for people with musculoskeletal health problems. Their work involves a broader field related to the functioning of the human body, including pain management, preservation of functionality, flexibility, and physical performance, among others.[16]

Musculoskeletal ultrasound is an efficient way to study injuries caused by trauma. and its use has increased in recent years. The study analyzes both the anatomy and functionality of the different osteoarticular components, allowing for the assessment of muscular, tendinous, and subcutaneous tissue structures. Its usefulness in the diagnosis of injuries to fibers, tendons, ligaments, and muscle tears caused by trauma allows for the detection and confirmation of sports injuries. Musculoskeletal injuries cause alterations that can affect different anatomical structures.[17] The term musculoskeletal disorder (MSD) covers a series of injuries that usually affect the hands, shoulders, elbows, wrists, and neck, and can significantly affect the productivity and quality of life of employees.[18] Associated with sports, they can prevent the injured area from functioning.[19]

Sports injuries are becoming increasingly common, given that high-performance athletes must undergo intense training in order to achieve high sporting results. Therefore, controlling the loads applied becomes extremely important.[20] In this type of ultrasound, a linear transducer is used in longitudinal and transverse sections, and in a comparative manner.

Specialists indicate that patients should be evaluated for symptoms of chronic fatigue syndrome (CFS), such as back, neck, or leg pain, or radiating pain.[21] Ultrasound is considered one of the most useful tools for a physical therapist, as these examinations can identify irregularities in soft tissues, especially muscle and ligament tears or injuries caused by complications from trauma or fractures. In other words, it can be used as an instrument for functional anatomical assessment, but also as a therapeutic element or as a guide for invasive procedures.

CONCLUSION

Imaging is a diagnostic imaging method that is extremely useful for all medical specialties, as it provides high-resolution images to confirm or rule out health problems affecting the anatomical structures of the human body. In this context, it offers multiple advantages in the evaluation of organs, among which the following are worth mentioning: it does not use ionizing radiation, it is an economical, efficient, and effective examination that allows for timely diagnosis. In short, ultrasound is a method that greatly contributes to all medical specialties in the identification, evaluation, analysis, resolution, and control of various health problems.

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CONFLICT OF INTEREST

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