Research and Innovation in Technical and Vocational Education and Training Vol. 2 No. 2 (2022) 210-215

RITVET

Homepage: http://publisher.uthm.edu.my/periodicals/index.php/ritvet
e-ISSN : 2785-8138

Safety and Security in Ultrasonography-Short Review

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DOI: https://doi.org/10.30880/ritvet.2022.02.02.024
Received 17 February 2022; Accepted 15 August 2022; Available online 30 September 2022

Abstract: Diagnostic sonography is a type of ultrasound that is used to examine a person's interior bodily components. A sonogram is a method of visualizing the body's soft tissues. Organs, tissues, and blood flow are all shown. Ultrasonography is a diagnostic imaging technology that creates pictures of bodily structures using high-frequency sound waves and a transducer. Ultrasonography is the instrument used to perform sonography, which is a technique for diagnosing different disorders. A sonographer uses an ultrasound instrument to do sonography. Ultrasound employs a tiny transducer probe to send sound waves into the body as well as capture the waves that return. Sound waves go through the region being investigated until they reach a tissue barrier, such as the border between fluid and soft tissue or soft tissue and bone. The benefits of sonography include the ability for the physician to perform emergency care at the bedside quickly, the ability to visualize other structures such as the aorta, pancreas, liver, and the identification of complications such as perforation, empyema, abscess, and the absence of radiation. This review discussed several ultrasound tests that are used in medicine to change the picture of the fetus in the womb. The evaluation of whether ultrasound exposure to the baby is safe, as well as recommendations for the safe use of diagnostic ultrasound equipment, will also be conducted. The effects of the ultrasonic contrast medium were connected to particle characteristics and the interaction of microbubble destruction and ultrasound beam energy.

Keywords: Safety, Security, Ultrasonography

1. Introduction

Ultrasonography is a typical way to diagnose and treat health issues. Ultrasonography can be used to guide diagnostic and therapeutic interventional procedures such as biopsies and drainage of fluid collections. Sonographers are medical professionals who perform scans that are generally examined by radiologists or cardiologists in the case of cardiac ultrasonography. Radiologists and cardiologists

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are experts in the use and interpretation of medical imaging modalities like echocardiography. Standard consultative ultrasonography requires the frontline EM physician to order the examination and to rely on the radiologist or cardiologist to perform it in a timely and clinically relevant manner (Whitson & Mayo, 2016).

Ultrasonography provides several advantages over other types of medical imaging. Because ultrasonography does not use ionizing radiation, it is superior to computed tomography and X-rays. Although MRI does not employ ionizing radiation, it does require the patient to sit in a noisy, enclosed environment. MRI, on the other hand, is far more expensive and less commonly available than ultrasonography. X-rays and other imaging modalities are slower than ultrasonography scans. X-rays, Magnetic resonance, molecular imaging, optical imaging, Ultrasound and radioactivity are some of the well-known, rapidly growing and frequently used medical diagnostic tools (Leena & Palwinder, 2014).

A sonogram, also known as an ultrasonography scan, is a treatment that creates images of the inside of the body using high-frequency sound waves. Ultrasound scans are a type of diagnostic imaging that can be used to check on the health of an unborn child, diagnose a condition, or guide a surgeon during certain procedures (Scott, 2018). An ultrasound is a test that creates images of the developing fetus and the mother's reproductive organs using high-frequency sound waves. A pregnant woman's typical number of ultrasounds varies from pregnancy to pregnancy. Ultrasound pictures aid in the diagnosis and treatment of medical problems. It can also help you figure out what's causing your stomach ache—detecting and locating various health issues in the body.

Even though ultrasonography provides benefits, it also has drawbacks. Ultrasonography has the downside of making it more difficult to see what is happening. In truth, weakness is a better word to use. Structures deep inside the body, such as those hidden behind air and bones, are difficult to image with ultrasonography. When there is air or gas, sound waves get in the way. As a result, ultrasonography isn't the best imaging modality for air-filled bowels or organs covered by the colon. In many cases, barium tests, CT scans, and MRIs are the choice procedures. The body's strong outer layer of bones makes it harder for ultrasonography waves to penetrate. Ultrasonography of the adult brain, for example, is still limited, though progress is being made. Ultrasound imaging also has the disadvantage of being less trustworthy than other imaging technologies. Ultrasound imaging is not as accurate as other imaging techniques (Sprayberry, 2015). Safety and security in ultrasonography should be emphasised due to the (i) improper or dangerous ultrasound exposure and (ii) controls by the International standards and National legislation (Francis, 2007).

1.1 Safety of Ultrasonography in Pregnancy

Ultrasonography is a technique that uses high-energy sound waves to analyse tissues and organs within the body. Sound waves on a computer screen produce echoes that form representations of tissues and organs (sonogram). Ultrasonography may be performed to help diagnose diseases such as cancer. It can also monitor the fetus (unborn baby) during pregnancy and medical procedures such as biopsies. It's also known as ultrasound. In general, healthy pregnancy should have two ultrasounds: one in the first trimester and one in the second trimester. Without a doubt, the passage of ultrasound through tissue upsets the cells in its route. The amount of energy conveyed in the beam, its frequency, and the environment in which the cells find themselves all have a role in whether or not this results in structural or functional changes (Ter Haar, 2010).

Ultrasonography during pregnancy has not been linked to any significant negative consequences on the mother, child, or fetus (Torloni et al., 2009). The primary goal of an ultrasound for a woman is to confirm her pregnancy. In addition, to determine the baby's age and growth in the pregnancy. This assists a provider in determining the due date of pregnancy. The heart rate, muscle tone, mobility, and overall growth of the baby in the womb are next checked. Aside from that, to see if she's expecting twins, triplets, or more (also called multiples). Finally, before birth, check if the baby in the womb is in the head position and the ovaries and uterus (womb).

When performed by your health care professional, ultrasound is safe for you and your baby. Ultrasound is safer than X-rays since it employs sound waves instead of radiation. Ultrasound has been utilised for almost thirty years with no known harmful side effects. Ultrasound is useful for ruling

out issues, although it cannot detect all of them. Some newborns are born without all of their features, such as a cleft lip or a cleft palate. An ultrasound might sometimes give the impression that there is a congenital disability when there isn't. While follow-up testing frequently reveals that the infant is healthy, false alarms can be frightening for parents (Ter Haar, 2010).

Ultrasound shows that the baby is developing normally in the majority of moms. If your ultrasound results are normal, keep up with your prenatal appointments. An ultrasound may reveal that your baby requires particular attention (Robyn Horsager, 2015). If your child has spina bifida, he may be treated while still in the womb. Your provider may try to turn your baby's position down if an ultrasound reveals that your baby is breech. You may need a C-section. A C-section is a procedure in which your baby is delivered through an incision in your abdomen and uterus made by your obstetrician.

The gel is applied to the skin over the examination region. It aids in the prevention of air pockets accumulating in the eye, which can obstruct the sound waves that generate the pictures. This water-based gel is simple to wash away from the skin and, if necessary, clothes. For prenatal diagnosis, the mother and the nude fetus should be considered relatively safe using ultrasound. On the other hand, the findings of this review should be viewed with caution. Security entails the absence of any negative effect, whether recognised or unacknowledged, and it should be remembered that the harmful consequences of ultrasound can be imperceptible at first and manifest years later (Torloni et al., 2009).

2. Radiation from Ultrasonography that Exposure to a Fetus and the Safety

A fetus is unlikely to be harmed by the majority of ways a pregnant woman may be exposed to radiation, such as during a diagnostic medical checkup or occupational exposure within legal limits. On the other hand, accidental or purposeful exposure over regulatory limits may be the reason for worry. Radiation harms pregnant women, but the fetus is shielded by a thick layer of uterine tissue and the uterus's surrounding walls. Exposure to doses more than 0.5 Gy can have serious health implications depending on the stage of fetal development. Health consequences include growth restriction, malformations, impaired brain function, and cancer (Patlas et al., 2020).

The fetus's radiation dosage from multi-detector CT imaging in pregnant individuals is between 10.8 and 14.3 mGy/100 mAs (Angel et al., 2010). Radiation's effects on the fetus greatly depend on the amount of radiation it is exposed to. The dose of radiation sources external and internal to the maternal body, such as the dose of radiation sources exterior to the mother's abdomen, must be considered when calculating fetal radiation dose. A dosage of radioactive material is then injected into the circulation, potentially crossing the placenta. The radioactive chemical can then be concentrated in tissues around the uterus, such as the bladder, and irradiate the fetus.

The fetal blood may detect some radioactive chemicals that enter the mother's blood. The concentration of the chemical is determined by its unique qualities and the fetus's developmental stage. Iodine, for example, is higher abundant in the fetus than in the mother tissues. According to several studies, the probability of fetal intelligence quotient (IQ) falling following irradiation is the biggest. A drop in a coefficient of roughly 30 IQ/Sv points (acute dosage) during the sensitive period of weeks 8-15 might be explained by a threshold of clinically identifiable IQ alterations (Valentin et al., 2003).

3. Guidelines for the Safe Use of Diagnostic Ultrasound Equipment

This guidance is designed to assist anybody who uses diagnostic ultrasonography equipment to make an informed decision regarding ultrasound safety and safeguard patients from overexposure (Padma & Cathy, 2018). This set of guidelines is based on the most up-to-date scientific knowledge available at the time of preparation, as well as expert input and evidence from worldwide. According to the rules for medical validation for ultrasound, ultrasound should only be used for medical diagnosis if it is supported by a medical practitioner. Diagnostic ultrasonography operations should only be carried out by personnel who have completed atraining session with the equipment and are completely aware of the procedure's potential risks. (Bly & Canada. Environmental Health Directorate, 1991).

Ultrasound is an imaging modality that may be used in several therapeutic contexts, including prenatal diagnostics. Diagnostic ultrasonography has yet to be proven detrimental to individuals, including the growing baby. Despite its great safety record, ultrasonic imaging entails the deposit of energy in the body. It should only be used for medical diagnosis by those who have been extensively educated in how to operate the equipment safely and correctly. This is the person in charge of regulating the ultrasound machine's output. This necessitates a thorough understanding of how scanners impact the object's thermal and mechanical bio-effects (Ter Haar, 2010).

The majority of ultrasounds may be conducted without any prior preparation. There are certain exceptions, such as some scans that require the patient not to eat or drink for a set length of time before the test, such as a gallbladder ultrasound (Sinan et al., 2003). A pelvic ultrasound can only be conducted when the patient's bladder is full. Before the test, the doctor will advise the patient onhow much water they need. Wait till the examination is over before urinating. Before proposing surgery to a kid, the doctor may suggest a very tight diet, a certain sort of vigorous but low-impact exercise, and a family education program. When scheduling an ultrasound examination for yourself or your kid, keep the following points in mind.

Current US scanners are more harmful in several applications. In Asia, the use of US medical apps is quickly rising, and US medical experts must raise awareness about the safety of these applications. Continuing education ensures that practitioners evaluate all available information regarding a practice's hazards and benefits. This can then open the door to self-control (Ng, 2002).

4. Conclusion

Ultrasonography imaging has been utilised for over 20 years and has a proven safety track record. The camera does not use x-rays or any other forms of ionising radiation. During pregnancy, ultrasound imaging should be used with caution. An ultrasound is safe for the patient and baby if conducted by a healthcare provider. Ultrasound is safer to use than X-rays since it employs sound waves instead of radiation. Doctors have used ultrasound for almost 30 years, and no hazards have been discovered thus far. Ultrasound is a standardised instrument clinicians use to monitor the health of a developing fetus and the mother-to-be. As a result, this instrument can be a huge contributor to the health community.

Acknowledgement

The authors would like to thank the Faculty of Applied Sciences, Universiti Tun Hussein Onn Malaysia, for the facilities that make the research possible.

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