Australian Journal of Basic and Applied Sciences
2018 December; 12(12): pages 131-143
DOI: 10.22587/ajbas.2018.12.12.21
Original paper
AENSI Publications
Journal home page: www.ajbasweb.com

Artifact in the Image of Ultrasound

Adil Ismail Nasir

Department of Radiology Techniques, Health and Medical Technology – Baghdad, Middle Technical University- IRAQ

Corresponding authors: Adil Ismail Nasir., Department of Radiology Techniques, Health and Medical Technology – Baghdad, Middle Technical University-IRAQ
Email-adilismail70@yahoo.com Mobil- 07706334200

Received date: 1 November 2018, **Accepted date:** 3 December 2018, **Online date:** 27 December 2018

Abstract
The aim of our study is to explain the physics of ultrasound in which it represented the key to understanding the artifacts. Since the artifacts also obey the same physical principles, and the ability of a radiologist to understand the fundamental physics of ultrasound, recognize common US artifacts, and provide recommendations for altering the imaging technique. it may be difficult to eliminate them.

Patient and Methods
This is an exploratory study carried out in the specialized medical hospital in Iraq from October 2016 to July 2017 on patients attending to the emergency department and examined by Ultrasound Machine type Philips,all patients undergo a full abdominal examination. More than (35) images have been collected from (departments of radiology). The Sonar- images which contained a spectrum of artifacts were classified according to the type of artifact, the region of exam such as (abdomen, chest, head, pelvic, neck, etc.) and the causative agent, as shown in table (1, 2). The study included the common artifacts presents in conventional and Doppler sonography used in medicine.

Result
Ultrasound imaging artifacts of acoustic origin associated with the resolution and path of propagation and attenuation are reviewed. The lateral and coarse lateral limits are of a complex nature, as failure to solve means losing details and two adjacent constructs can be visualized as one. The apparent resolution near the transformer (s) is not directly related to the tissue texture, but is due to the interference effects of dispersal of the dispersants in the tissues. The echoes produce a range of echoes of equal artifacts that diverge into real reflectors. The tool for the displayed images represents objects displayed on one side of a powerful reflector, which appear on the other side as well. Shading and refinement of useful antiques to determine the nature of the masses. Improvements result in low attenuation objects in the audio path while shading results from highly reflective or highly attenuated objects. Additional artifacts include section thickness, refraction, multiple pathways, side lobe, grating lobe, focal reinforcement, comet tail, ring down, speed error, and range ambiguity. The key to understanding artifacts is the physical basis of ultrasound imaging. It may be difficult to eliminate artifacts, because it also obeys the same physical principles.

Conclusions
Sonographers or Ultrasonography who have a good understanding of ultrasound, including ultrasound, how they are produced, how a picture is created, can educate clients and other members of the medical health care team more effectively, and ultimately, increase the quality of care. Technicians may also wish to expand their basic knowledge of ultrasound as part of their education and training to increase their abilities and responsibilities. The ultrasound detected a change in the adverse local tissue reaction (ALTR) size and degree difference with a higher resolution and higher agreement with MRI compared to the initial assessment, indicating that the ultrasound is valid and useful Just as ultrasound is performed by professionals in human medicine, it is likely that this imaging technique will someday be a common skill for Sonographers or Ultrasonography, giving more time for the Phycsions to interpret images and treat the patient. The operator can be alerted to the possibility of technical presence, and how to identify it only through appropriate education and experience, where it is easy to identify the Doppler effects in general and can provide evidence of diagnosis if interpreted correctly. It is essential in making ultrasonography (US) a clinically useful imaging modality and also understanding the physical basis of US image formation is critical to understanding US artifacts and thus proper image interpretation.

Keywords: Artifact, Ultrasound, scattered, Reflection, Transducer.

INTRODUCTION

Despite the great significance of technological progress in diagnostic ultrasound types of equipment, artifacts will remain as the diagnostic challenge for the sinologist's sonographers. Artifacts can be defined as echoes which are shown on the images not corresponding in intensity or location to the real picture of patients. Some types of artifacts are unwanted & may interfere with

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound.. Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

the result interpretations, while other artifacts help in identification of specific structures. Appreciation of artifact inherence to the diagnostic methods is necessary & to its occurrence, despite the suitable techniques & machine settings.

The operator can be alerted to the possibility of artifact presence and how to recognize it only by appropriate education & experience. Artifacts are inherent to all methods of radiological imaging. Never the less, in ultrasonography exams, artifacts can cause particular troubles, and in most cases, they may be identified for what they really are. However, a missed diagnosis may result by artifacts or sometimes one may observe them as a real abnormal finding. The key to understanding artifacts is the physical basis of ultrasound imaging. It may be difficult to eliminate artifacts, because it also obeys the same physical principles. Thus, it is of great importance to recognize artifacts so that to appreciate their significance & avoid the potentially significant errors in diagnosis. (2)

Basis of Ultrasound

<u>What is an ultrasound?(3)</u>

Ultrasound is the term used to describe a high-frequency sound wave, usually over (20 000Hz). These wavesinaudible to human and are able to transmit in beam,&are used for scanning of body tissues. Medical ultrasound frequency is from (2-10) MHz & the duration of the pulses is about 1 microsecond. The pulses are repeated for about 1000 times/ second. The waves are altered by different tissues and in different ways. Some tissues reflect the waves directly, while other tissues scatter them before their return to the transducer in the form of echoes. The waves pass through the tissues at different speed e.g.1540 micro/ second for soft tissues, in air (lung) are 600-1100 micro/second (2), and in the bone are (2500-5000 micro/second).

There is a need to amplify the reflected ultrasound pulses that are detected by the transducer in the scanner. The echoes coming from the deep structures weaker or more attenuated than those coming from the superficial structures or parts & therefore, they need more amplification. The amplification can be changed by ultrasound controls.

When the echoes return back to the transducer, there will be a possibility to reconstruct a two-dimensional map of althea tissue in the beam. Strong echoes are those echoes of high intensity, which are seen as brighter screen dots.

Use of Ultrasound (4)

Because the ultrasound is a form of non-ionizing radiation, it can be used in many types of examination without any risk on the patient and it can give many information about the disease but it cannot be used in the diagnosis of bone and gas because there will be many artifact so its use in. (Limited only for soft tissue and it also uses to determine whether a structure is solid or cyst).

The ultrasound Beam

As the wavefront travels from the transducer face, it will spread out, immediately adjacent to the transducer face, the ultrasound wavefront is finely collimated and rather well-defined(5). This is termed the near field and its depth is determined by the transducer according to the following:-

$$D = \frac{D^2}{42} \qquad \text{Depth} = \frac{(\text{Diameter})^2}{4\ \text{Wave Length}}$$

At the distance from the transducer face described by this equation, the ultrasound beam begins to diverge. This is the beginning of the far field. The divergence degree in the far field can be determined by applying the transducer size and frequency according to the following equation. (6)

$$\text{Sin}\ \theta = \frac{1.22}{D} \qquad \lambda = \frac{V}{F}$$

$$\text{Sin}\ \theta = \frac{1.22V}{DF} \quad 1.22\ \frac{V}{F}$$

$$= \frac{\;}{\frac{D}{1}}$$

Where Θ Is the angle of divergence

λ Is the wavelength

D Is the diameter of the transducer

Type of Reflection

1- Specular

Relatively regular, with a smooth surface and large shape objects originate echoes. This echo is relatively intense and angle-dependent. It occurs when the interface higher than the sound beam. The reflecting boundary acts as a mirror if it is much wider than the wavelength. Fetal skull and the diaphragm are examples of specular reflection. This can cause mirror artifact such as the liver mirror artifact due to the diaphragm see (Fig.3) (7)

2 - Non-Specular (scattered)

Echoes, that are fewer angle-dependent & less intense , originate from small, weak- reflective and irregular-shaped objects. Its occurs when the interface << sound beam. In the original direction, only small fractions of the ultrasound wave are scattered. Liver & kidney parenchyma are examples of scattering media.

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound..Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

Note; When there is a greater difference between the characteristic acoustic impedance, the reflected fraction will be greate. When the propagation speed ratio is greater, then the refraction will also be greater.

Type of transducer (Probe)

1- The linear array

These types of scans have rectangular shape transducers. They are instrumental and essential in obstetrics, breast & thyroid gland.

2- Sector Transducer

The scans here have fan shape, usually triangular & originate from very small acoustic windows. This type of scanners might be used even in the presence of a small space for scanning. They are used in scanning of upper abdomen, gynaecological and cardiological examinations. (7)

3 –The convex transducer

The scans that are produced by this type are often located between the liner & sector scanners, and they are useful for all body parts except the specialized echocardiography.

The Doppler ultrasound

The Doppler ultrasound can be used for detection and measurement of the blood flow and is the major blood cell reflector. Doppler shift can be calculated from this equation:

$$DF = \frac{2fv \cos q}{C}$$

Where DF is Doppler shift frequency, which is then transmitted frequency**. V**is the blood velocity. C is the speed of sound. q is the angle located between the sound beam & the direction of moving blood.

We can use this equation to measure blood velocity. (6)

$$V = \frac{Df.c}{2f \cos q}$$

<u>Types Of Doppler Unit</u>

1-The Continuous Wave Doppler Unit: There is a continuous ultrasound, with high velocities are measured accurately, but all movements along with the ultrasound appear together as there is no depth resolution.

2–The Pulsed Wave Doppler Unit: The ultrasound here is transmitted in the form of pulses of ultrasound into all parts of the body. With a good resolution of depth, it is able to measure the speed of blood in certain blood vessels directly. The disadvantage of this type is that it is unable to measure the high velocities of blood in deep blood vessels, and also the high velocities may appear wrongly as low types of velocities (Ulia sign).

3–The Color Doppler Unit: The direction & distribution of the blood flow in this type is seen as the two-dimensional image where the velocities can be distinguished by the appearance of various colors.

4–The Duplex Doppler System: It is possible to measure the blood flowing by Doppler ultrasound, because of the location of blood vessels by a B-mode ultrasound image. The beam of the Doppler can be permitted to be directed accurately to any specific blood vessel due to the combination between the Doppler system & the B-mode image. In this system when the scanning angle is not correct, the blood flow appears disturbed to see **(fig. 11).**

5–The Power Doppler: By this Doppler, the amplitude or the signals of the power of the Doppler is depicted rather than the shift of frequency, permitting the detection of a larger scale of the Doppler shift, and therefore to a better visualization of the small blood vessels ,but at expense of the directional velocity information.

The power Doppler seems to be more sensitive to the art factual motion e.g. the transducer movement. Even in the small blood vessels, such as the peripheries of the kidneys & lymph nodes, the slow flow can be seen.

METHODOLOGY

Patient and Methods

This is an exploratory study carried out in the specialized medical hospital in Iraq from October 2016 to July 2017 on patients attending to the emergency department and examined by Ultrasound Machine type Philips; all patients undergo a full abdominal Scan.

More than (35) images have been collected from (Radiological departments). The sonar- images which contained a spectrum of artifacts were classified according to the type of artifact, the region of the exam such as (abdomen, chest, head, pelvic, neck, etc.) and the causative agent, as shown in table (1, 2).

The study included the common artifacts presents in conventional and Doppler sonography used in medicine.

Many pictures have been collected from different hospitals include a various picture for many types of artifact of ultra-sound as shown in the table below.

Table 1- Artifacts in the conventional U.S

Type of artifact	**Region**	**Cause**
1- Acoustic shadow	Abdomen (a,b)	Strongly reflected interface (stone)
Acoustic shadow	Chest (c,d)	
Acoustic shadow	Head of fetus (e)	
2-Reverberation artifact		The difference in the acoustic impedance
3-Mirror	Pelvic (a,b,c)	Extra reflections come from the interface within the body itself.
	Pelvic(a)	
		Scattering and refraction (fluid) filled structure.
4.Enhancement		Scattering and refraction (fluid) filled structure.
Enhancement	Abdomen (a,b)	Scattering and refraction (fluid) filled structure.
Enhancement	Pelvic (c,d)	Gas reflected ultrasound
5- Gas	Neek (e)	Gas reflected ultrasound.
Gas	Abdomen (a)	A collection of closely-spaced perpendicular (vertical) echo as well as one or (two) vectors within the image of ultrasound.
6-Comet tail	Pelvic (c)	
	Abdomen	The sound reflected by adjacent structure.
7-Slid-lobe		When the boundary between the wall of fluid-structure and its contents are not perpendicular (vertical) to the interrogating sound beam.
	Pelvic	
8- Slice thickness		
	Abdomen	Oblique interface between the tissues of different acoustic velocity.
9- Split image		An electrical interface from nearby equipment.
	Pelvis (a,b)	Wrong T.G.C. time gains compensation.
10-Breathing artifact		
11-Noise artifact	Abdomen	
Gain blurring	Abdomen (a)	
	Abdomen(b)	

Table 2- Artifact in the Doppler Ultrasound

Type of Artifacts	**Region**	**Cause**
12- Mirror	Blood vessels	The divergence of the Doppler beam is bi-directional along with the axis of the long vessel.
13- Angle correction	Blood vessel	Incorrect angle.
14- Aliasing (pulsed Doppler (a), Color Doppler (b)	Blood vessel	Insufficient sampling rate.

RESULT & DISCUSSION

Artifacts in the conventional ultrasound

There are three types of artifact according to the causative agent

1 - Artifacts caused by the patient [(7)]

1- **Acoustic shadow**:

Bones, calculi& calcification may lead to the formation of an acoustic shadow. When the sound strikes this interface, there is no sound conduction through the area (shadowing), many of the sound beams are absorbed and refracted. This can help in confirming a gall stone or a kidney stone as shown in**).** On the other hand, large shadowing artifact may obscure a deep pathologic process fig (1 a, b.) Sound shading occurs when the ultrasound beam collides with an area of gas or mineralization. [(4.7)].The gaseous or metallic structure inhibits the passage of the beam, and then bounces either back to the transformer or are absorbed. Because the ultrasound beam cannot penetrate this region, the echoless shadows appear on the screen far to the area. Sound shading is often seen with the calculation of urine or gas inside the digestive system. This tool helps in determining accounts, but it also prevents checking the deeper structures (NYLAND TG, et al 2002 early proved this artifactthis is in agreement with the results obtained by several authors and KEALY JK, MCALLISTER H.2005). In order to show this pathologic process changes the focal zone or change the direction of the transducer. Ultrasound attenuation is another mechanism that can affect ultrasound image quality; ultrasound interaction with tissues results from absorption and dispersion mechanisms (Kremkau and Taylor 1986 reported that(This study was later found to be correct). Ultrasonic attenuation is usually designed to be proportional to frequency; therefore, by reducing the beam frequency, the effects of attenuation are reduced by ultrasound, but as a result, the resolution of the image is compromised.

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound.. Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

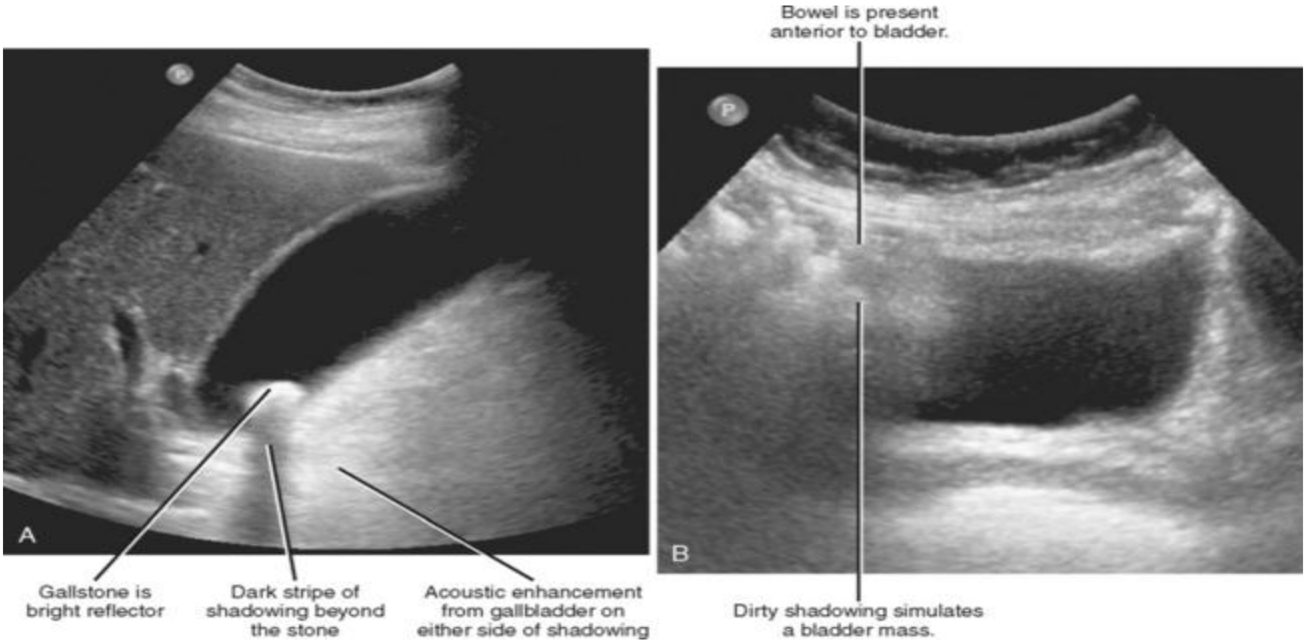


Fig.(1a,b) show Acoustic shadow artiifact:

2. Reverberation Artifact:[(8)]

After the passage of an ultrasound beam from one tissue to another with a different acoustic impedance, this reverberation artifact will occur. The actual sound velocity varies from 1,470 m / s in fat to 1,665 m / s in collagen (Goose et al., 1978 proved similar outcome). Focus delays are often inaccurate when the tissue layers have a different velocity of sound between the converter and the interest device (Kremkau and Taylor 1986 they proved the study). The ultrasonic beams become non-focused due to the unevenness of the acoustic speed. This effect is known as stage deflection or reverberation.

... Reverberation is most commonly seen adjacent to the bladder anterior wall and may produce parallel lines e.g. the reverberation between the layers which are parallel to the tissue below the skin can be detected as a parallel line in urinary bladder Fig.**(2).** The reverberation from the anterior surface wall can make a simple cyst appear complex. To distinguish this artifact from real structures,

1. Using a transducer of different frequency.
2. Bouncing the transducer on the abdominal wall and noticing that the second linear structure moves in exactly the same fashion as the strong echo nearest the transducer.
3. Scanning the same area from a different angle.

Fig.(2) Reverberation Artifact

· Reverberation: Multiple, equally spaced echoes caused by bouncing of sound wave between two strong reflectors positioned parallel to the ultrasound beam

3-Mirror Image:

Mirror Image occurs when an extra reflection arises from the interface within the same body. Like a real mirror, the sound reflects an angle to another interface so that the artifact is shown as a virtual object, for the example mirror image of the liver through the diaphragm. Theoretically, there should be no echoes from the lungs because they are full of gases, but in fact there is a duplication of structures within the liver above the diaphragm. It is commonly seen during ultrasound imaging in the abdomen when the ultrasound beam travels across the liver and gallbladder to the diaphragm 8. Some of the echoes are reflected back in the

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound..Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

liver and gallbladder. However, echoes from this second pass are assumed by an ultrasound device to have travelled in a straight line. Because they take longer to return, they are interpreted as double the depth of the original echo. The result is that the liver and gallbladder appear on the image on both sides of the diaphragm (PENNINCK DG et al 2002 they are an agreement with the study). See Fig. **(3).** Lesions within the liver or spleen adjacent to the diaphragm can be "duplicated" in the lung. Mirror image has a benefit that if it is absent in the lung, it can be deduced that pleural effusion is present. To correct this artifact try to scan the area from another position.

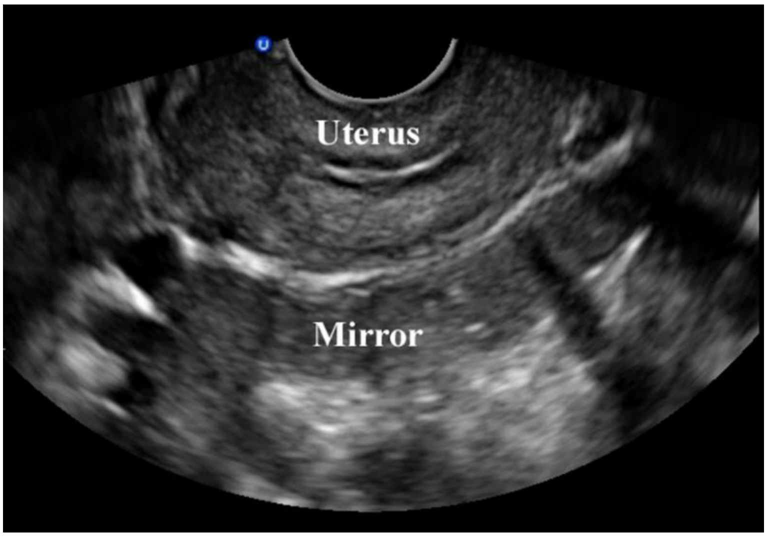


Fig.(3) Mirror Image: Sound reflects off a strong reflector (mirror) and is redirected toward a second structure

4. Enhancement effect:[(10)]

Scattering and refraction cause an enhancement, which can be observed behind the fluid-filled structures like the gall bladder and urinary bladder or even behind the cyst and may occur behind the vessels such as the portal vein acoustic enhancement is present when the sound moves for a certain distance through the homogeneous fluid. Due to the low reflection of the fluid, the sound waves are less attenuated and have higher amplitude distally when compared with the adjacent sound waves. These procedures increase echogenicity which is shown as a bright band behind the cyst of fluid-filled structures Acoustic stimulation, also called a transition, is called an area of increased echo of distant echogenicity of structures with lower attenuation of ultrasound (PENNINCK DG.et al 2002 they proved the study). **Fig. (4).** The enhancement has the benefit that it is useful in differentiating between solid and cystic lesions, in addition to aiding the sonographer in seeing deep structures. In order to correct this artifact, the sonographer should diminish the overall gain and adjust the Time Gain Compensate(TGC). [(11)]

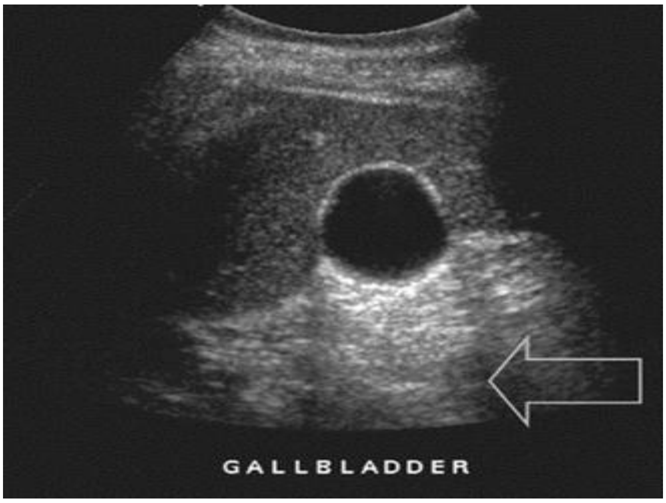


Fig. (4)Enhancement Artifact

5. Gas Artifact[(3)]

Gases reflect ultrasound & obscure the tissues behind them by means of shadowing & refraction. Pancreas, liver, Para-aortic lymph nodes, ovaries and uterus can be obscured by intestinal gases. Gases can sometimes move easily in the bowels for example, in case of full urinary bladder, the ovaries & uterus are easily observed, since bowels are pushed upwards outside the viewing field. In other conditions, it may be of necessity that oblique, lateral, and posterior scans be done while the patients are on

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound..Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

standing or sitting postures. The gas artifact is shown in **Fig. (5).**Sometimes gas artifact is avoided by using deep inspiration and in all abdominal examination, the patient must be fast.

Fig. (5) Gas Artifact

6. The Ring Down Artifact:

This ring-down type artifact or comet-tail artifact is shown as a deep line to the strong reflector. A metal piece, like a bullet shot or a surgical dip in the body, may cause this artifact. This artifact is not a real echogenic line, but a collection of echoes which seem closely-spaced vertical as well as single or double vectors in the ultrasound image. Originally, these artifacts have been considered to be the sounds which enter the gas bubble or metal and reverberate backwards in the structures each time, and they send some sounds back to the transducer.The sound pulse then "sonatas" the metal and cause it to ring.[(12)]This artifact never appears deep to the calcifications or to the calculi , and it usually happens deep in the cholesterol crystal in the gall bladder wall. These artifacts have been referred to as the "V-shaped artifacts". [(13)] They appear as two to three "rings “only, and the far distal artifact is often shown smaller than the proximal one. Ring-clown "is a common set of ultrasound-related ultrasound with gas groups. This gas is usually inside the digestive system but maybe

Inside the yellow tree, Abscess cavity or anywhere Inside the body. (Sarti DA.et al. 1980 as they proved).When seen, the clown ring Confirms the presence of this gas and distinguishes from other sources of bright resonance, such as Calcification. Ring-clown has a solid appearance line or a series of parallel bands radiates away from the gas group. An artifact, " Comet tail (Ziskin MC. Et al. 1982 this study was gone with the previous study)..The plat-like cholesterol crystal is thought to be oriented perpendicularly to the beam so as to cause ringing. The ring artifacts are most commonly occur distal to the diaphragm see **Fig.(6).** To correct this artifact scan the area from a different angle. As the last word, we would like to emphasize

The difference between "tail of the comet" and "downloop" Archaeology. While it may look superficial Similar, they are produced by two completely different Mechanisms. Unfortunately, some confusion It has finally emerged between two (Thnckman Dl, et al, 1983 it is corrected by them).

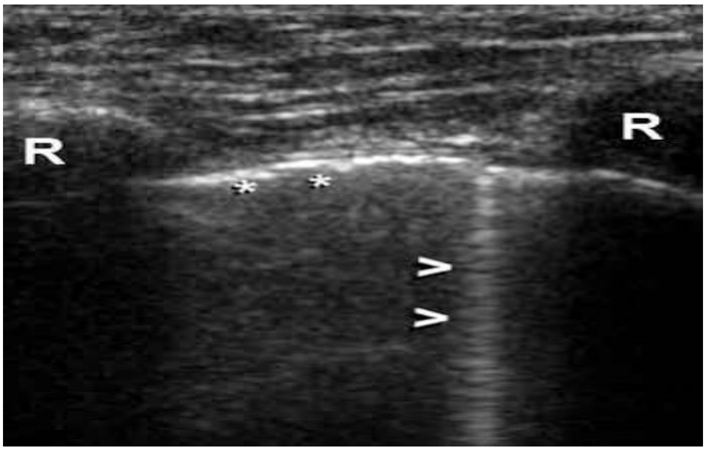


Fig. (6)Ring down artifact or comet-tail artifact

Comet Tail: Solid hyperechoic line directed downward (reverberation with spaces squeezed out)

7. Slice Thickness[(14)]

Art factual echoes are seen within a cystic structure close to the distal wall due to the wide beamwidth. It is caused if the boundary between the cyst wall, gallbladder or urinary bladder and the containing fluid is not perpendicular or vertical to the interrogating sound beam. The echoes which are present within the returning beam include echoes from liquid and solid structures, and they are averaged by the processor. As a result, the boundary between the solid tissue & the fluid is seen as an indistinct structure with low echogenicity. Slice thickness artifacts may sometimes mimic sludge or layered material (concernments, blood dots) in the urinary bladder or gallbladder (**Fig. 7).** In order to avoid this artifact, change the focal zone or scan from a different angle. Often seen in fluid-filled structures (eg bladder, gallbladder and cysts), a slice thickness artifact is produced when a portion of the ultrasound beam is located outside the structure being under (KREMKAU FW,et al,1986 well proved by them). This part of the ultrasound package interacts with neighbouring tissue, it is a fault displayed in the cavity of an echoless structure. It often takes the form of sediment or mass and is often referred to as pseudo sludge when correlated with gallbladder (FISKE CE.et al 1982 proved the study). However; an artifact can distinguish a thickness slice from real sediments. The real sediments have a flat surface and move to the patient's side regardless of location, whereas the slide thickness effect has a curved surface and remains perpendicular to the ultrasound beam (FISKE CE.et al 1982 recently similar result were reported).

Fig. (7) **Slice Thickness**

8. Split –Image Artifact (The refraction artifact)

The sound beam bending at the oblique interfaces indifferent acoustic velocity tissues is known as refraction. It occurs when the ultrasound beam hits the structure at a slanted angle. The change in tissue density results in a change in speed and this change in speed causes the beam to bend or break. 2.5 This type of tissue reaction can also cause artifacts that need to be recognized by an imaging specialist (CURRY TS III, et al 1990, proved this study and Similar results were reported recently NYLAND TG, et al.,2002). This artifact is the displacing of the distal structure by more proximal beam refraction. An example of this is the superior mesenteric artery image, which can duplicate on the transverse holding of the transducer over the midline. When a beam appears pointing towards the right side, then the sound can be refracted back to the midline area by the oblique appearing interface which is present between the posterior side of the rector's muscle & the triangular fat pad which is located behind. Duplication artifact may also appear in the pelvis resulting in the appearance of a singleton early gestational sac as a twin, the copper (IUD Intrauterine Device) in the uterus may appear as a duplicated beam as well. Thus, it is called as a "copper-14" artifact Fig. **(8).**[16]

Moreover, the refraction may deeply displace the deep interface location e.g. the diaphragm to the small cyst seen in the liver. The passage of sounds can probably be delayed by a large cyst leading to the appearance of the diaphragm further than its position, because of the slower movement of the second sound in the fluid than its movement in the liver. A peculiar effect on the diaphragm can be caused by smaller cysts. In the superior side of the cyst, sound beams can be refracted inferior to the actually far away diaphragm. The sound beam can be refracted superior to the closer location of the diaphragm from the inferior side of a cyst. Hence, the segment of the diaphragm may appear as a rotating part because of the refraction. This artifact can be eliminated on moving the transducer to one side or to the other.

Fig.(8) Refraction may cause single gestation to appear as a double gestation (trans. view)

9. Movement artifact (breathing):-

If the patient breath, while you are scanning the image, may by distorted and blurred because a part of the scan will be performed during inspiration and part during expiration, for example, when scanning a kidney, shortening or lengthening may occur if the patient breathes during the scan see (fig. 9). the diaphragm and adjacent liver may be interrupted and blurred if the patient takes a breath in the middle of the scan. This artifact may occur due to differences in the focal zone during respiration. To correct this artifact ask the patient to hold his breath, or utilize the cine loop control to review the last frames of the scan and

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound..Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

freeze when the most desirable image appears. If the patient is unable to hold his breath, make sure the persistence is set low and that simultaneous multiple electronic focusing is not slowing the frame rate. These techniques will shorten the time it takes to stabilize the image before it can be frozen.

Fig. (9) Movement artifact (breathing)

2. Artifact caused by Instruments:

Some of which related to the type of instrumentation used example side lobes and some which occur when the equipment is not functioning satisfactorily.

1. Sidelobe artifact :

Side lobes are secondary echoes outside the main beam. It has a width of many millimetres at least in a focal zone and even wider than that in the close and farthest zones. Adjacent structures can reflect the periphery of the sound beams. The appearance of echoes can be caused by the structures as much as 4.5 degrees from the central vector by the side lobes of the main beam. Note that echogeniccurved lines in the bladder are tangential to the interface of bladder/uterine, and that happens when the main beams point towards the cervix. Side lobe artifacts may still be able to hit the interface of the bladder/ uterus to produce axis echoes. **Fig. (10):** the side lobe artifacts may be further subjected to appear with curved & phase linear array transducers. Sidelobe impact occurs when echoes of sound waves do not follow the direction of the primary ultrasound package. These echoes are placed inaccurately in the picture as if they were from the initial package.. The side lobe can be generally

Eliminated by reducing the gain or adjusting the depth of the ultrasound beam (LAING FC, 1982 the study were proved).

Fig. (10) Side lobe artifact

2.Art factual Noise:-

At factual noise is caused by electrical interference from nearby equipment (e.g. in an intensive care unit). Such noise has a repetitive pattern unlike the overall increase in the echogenicity seen with too much gain. This type of noise produces a pattern over the normal ultrasound image. To correct this artifact, the equipment can be modified to prevent such interference if it occurs in the ultrasound laboratory. You may be able to disconnect the interfering equipment during the scan. Get warmest may be responsible.

2. Calibration Problems:-[(9)]

Calibration problems may not be apparent on the image, but subsequent measurements using another ultrasonic system or phantom may show erroneous calliper measurements. Measures such as the biparietal diameter may be wrong with tragic clinical consequences. This artifact can be recognized by comparison with other system or by calibration check can such subtle measurement changes be detected. To correct this problem, the calibration check performed at regular intervals. Measurements should be performed in the center of the image where calibration is most correct and not at the edge of the video monitor.

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound..Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

3. Main Bang Artifact

There can be many echoes from the skin-transducer interface in the immediate subcutaneous tissues. There is such a strong interface between the skin and the transducer that is almost impossible to avoid the main bang artifact completely with order transducers. The main bang is less of a problem in new transducers because the multiple matching layers give the transducer itself impedance very close to that of the skin surface. Poor technique such as too much time gain compensation or rib artifact is responsible for the most superficial artifact. This artifact causes diagnostic confusion, that subcutaneous and superficial lesions will be hidden within the main bang artifact. To correct this artifact, use a higher-frequency transducer which able to diminishes the problem. Decrease the near field again. Use of a stand-off pad will avoid the main bang artifact to some extent.

4. Propagation of the speed error:-[9]

As said before, an ultrasound machine presumes that the speed of sound is constant within the organic tissue, but sound velocities are really totally different in organic tissues. On scanning an area which contains tissues having different velocities, incorrect depth assignment can be seen far away from the tissue having lower velocity. Fast and fluid-filled structures are often observed as a cause behind this artifact. Echoes which move throughout lesions will reach the transducer with a little delay, and they will be assigned in deep positions, creating a break appeared in the structures that are located in the posterior side of the lesion, or diaphragm or even kidneys.

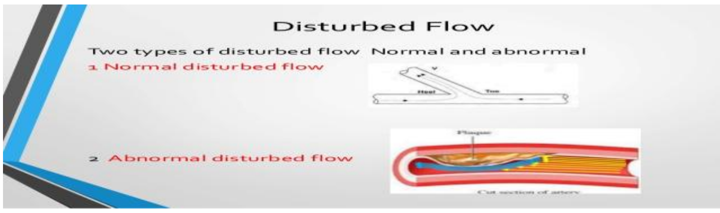
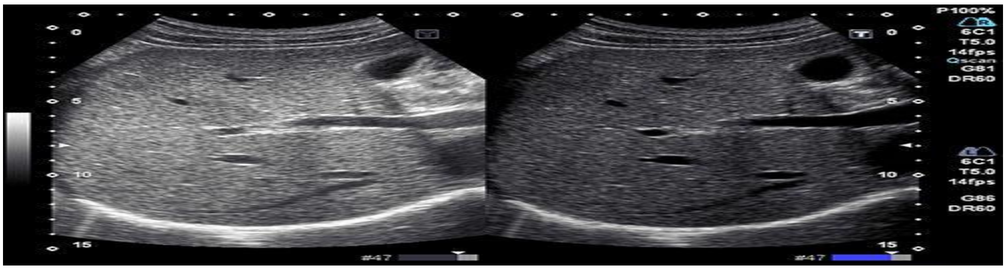


Fig. 11 Disturbed Flow

3. Artifact Caused By the Operator (Technique Artifact):-

1. Time Gain Compensate:-[4]

Artifacts are created by poor time gain compensation (TGC) technique are common. Extra echoes or too few echoes may be introduced owing to the wrong use of TGC. Numerous echoes may be created in superficial structures and not in deep structures and vice versa. This appearance may also be caused by wrong choices of the transducer with the result that the focal zone and frequency concentrated on superficial structures. Low gain causes the structures of hyperechoic to be hypo echoic such as the diaphragm may appear as fluid see **Fig. (12 a)** and solid mass appears as cyst and vice versa in the too much TGC. Also excess gain sees **Fig.(12 b)** may cause (Noise Artifact) in which a normally echo-free structure contains low-level chose, which could represent pathology but maybe artifact. Comparison with a known cystic structure such as the urinary bladder helps in deciding whether possible noise is a technical artifact or real structure. To correct this artifact adjust the gain without lesion structural information in the known echogenic area such as the liver. **Fig. (12 c)**



Fig(.12 a) Focus too high

Fig. (12b) Focus low\

TGC

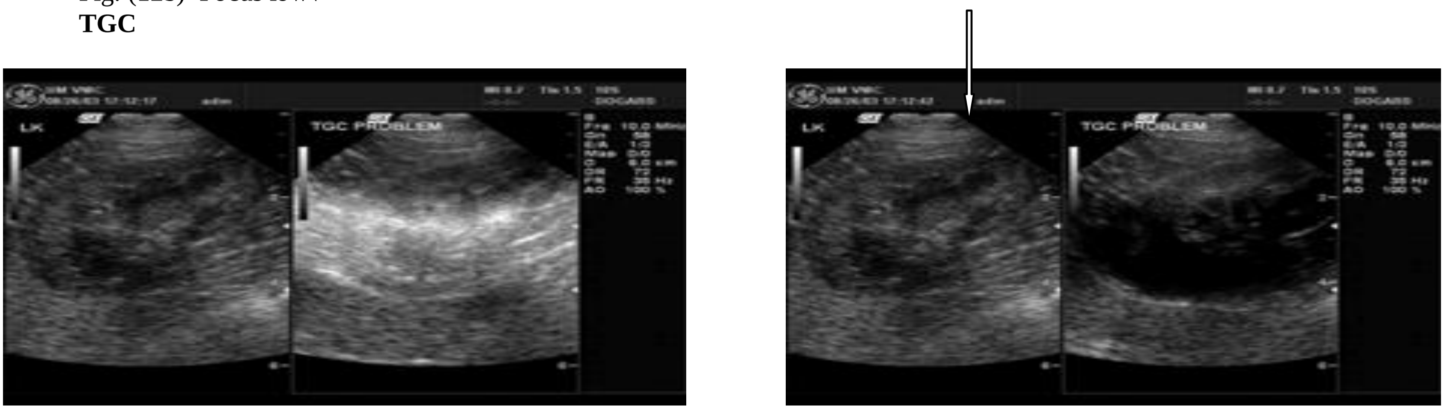


Fig.(12c) Occurs when the user has not appropriately adjusted the TGC curve

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound..Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**

2.**Operator Scanning Speed :-**[(9)]

If the sonographer scans rapidly, artifact known as dropout lines are created. Most digital units receive information rapidly enough to avoid this artifact. Some units appear to have gaps between the lines of an image because they have not been smoothed. Computer processing can eliminate these little gaps between beamlines in a cosmetic. But uninformative fashion (i.e., the gaps are filled in with false echoes). To correct this artifact, perform the scan at a lower speed.

Artifacts in Doppler Ultrasound

1. Spectral Mirror Image :[(18)]

If an ultrasound beam is vertical to the blood vessels, then there might be the usurious impression, which has no flow or no (occlusion), or the direction of the flow might occur in bi-direction, like the mirror image seen in **fig (13).**

The latter type of artifacts is known as the artifact of (spectral mirror image), &it occurs because of the Doppler's bi-directional beam divergence along the axis of the long vessel.

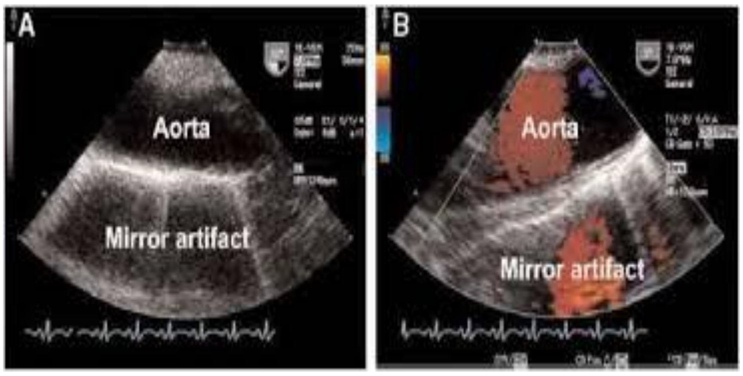


Fig.(13) Spectral Mirror Image

2.Angle Correction

Emphasizing on the angle correction's accuracy is essential; which can lead to an inappropriate estimate of the results in spurious velocity determination and in potential misdiagnosis. Angle correction does NOT need to be performed if you are going to plug the velocity measurement into an equation where the units drop outs mention below Fig. (14).

– e.g. Resistive index (RI) = (S-D) / S
– S=peak systolic velocity
– D=lowest diastolic velocity

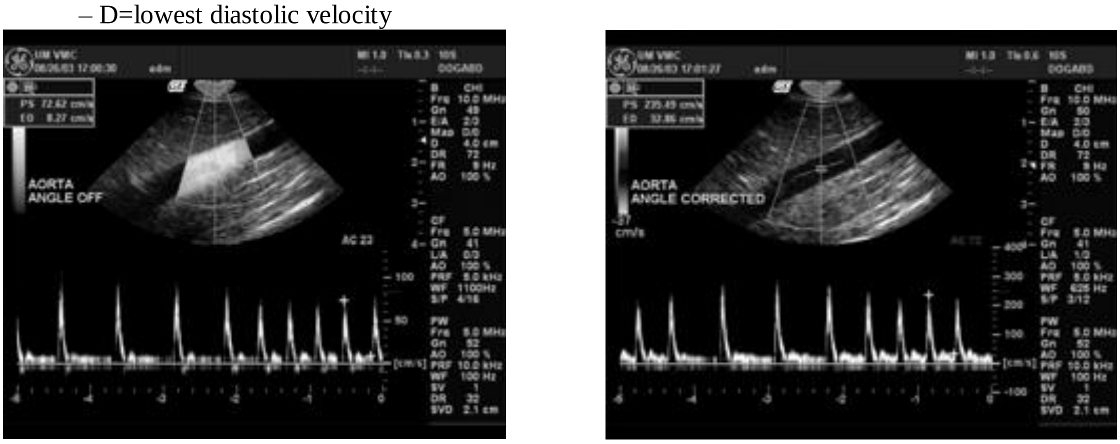


Fig. (14).Angle Correction

3. Aliasing :[(20)]

Insufficient sampling rate may lead to aliasing artifact, which is observed if the measured frequency shift equals more than twice the pulse repetition frequency (SyQuest frequency**).**

This artifact leads to the formation of a wrap around the Doppler spectrum in pulsed or in colored Doppler US. Aliasing at pulsed Doppler seems like a (folding-over) of the forward flow of systole in the opposite direction. Aliasing at colour Doppler US may be shown as a mixture of colors or as a focus of colors in the vessel corresponding to a continuum of colors folded over from normal flow in the opposite direction within the blood vessel (fig 15). Since aliasing is a result of the high-frequency shift or inadequate sample rate or both, it might be the marker for sites of the high-velocity flow, and is therefore, a useful artifact for stenos is detection. During artery mapping with color Doppler US, and when a region aliasing is encountered, a more detailed analysis must be prompted with pulsed Doppler to detect the presence of the ratio of an elevated peak systolic velocity. Increasing the pulse repetition frequency or the use of the low frequency transducer can be performed to reduce the aliasing artifact, and therefore decreasing the Doppler shift**.**

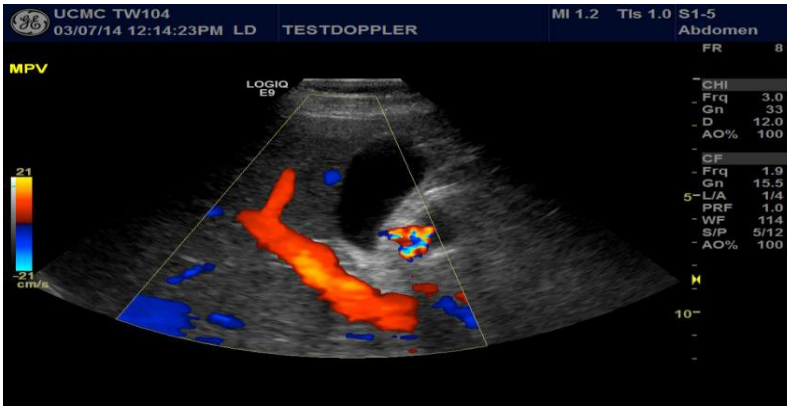


Fig. (15).Aliasing Artifact

Aim of the study

Artifacts are attributes of the image generated by the ultrasound that does not really represent the area being scanned (KREMKAU FW et al, 1986 they are proved). It is important that the photographer be able to identify the common art pieces and understand how and why they occur so that they can be eliminated if necessary, by modifying the imaging technique. Some artifacts can be useful, which helps the diagnostic potential of the ultrasound. The ability of a radiologist to understand the fundamental physics of ultrasound, recognize common US artifacts, and provide recommendations for altering the imaging technique is essential for proper image interpretation, troubleshooting, and utilization of the full potential of this modality

Despite the significant technological advances diagnostic ultrasound equipment. Artifacts still represent a challenge for the sinologist and pornographer.

The aim of our study is to explain the physics of ultrasound in which it represented the key to understanding the artifacts. Since the artifacts also obey the same physical principles, it may be difficult to eliminate them. It, therefore, becomes importance, to recognize so that their significance can be appreciated and avoid potentially important diagnostic errors. Archeology is widespread in the United States, and although some are not generally desirable, others reveal valuable information about the structure and composition of the tissue being photographed. An ideal American technique is needed to minimize effects that may interfere with image interpretation. In addition, radiologists should be able to use artifacts on American images to improve diagnostic privacy.

CONCLUSION

Sonographers or Ultrasonography who have a good understanding of ultrasound, including ultrasound, how they are produced, how a picture is created, can educate clients and other members of the medical health care team more effectively, and ultimately, increase the quality of care. Technicians may also wish to expand their basic knowledge of ultrasound as part of their education and training to increase their abilities and responsibilities. Just as ultrasound is performed by professionals in human medicine, it is likely that this imaging technique will someday be a common skill for Sonographers or Ultrasonography, giving more time for the Phycsions to interpret images and treat the patient. It is essential in making ultrasonography (US) a clinically useful imaging modality but also can lead to errors in image interpretation and can obscure diagnoses. Many of these artifacts can be understood as deviations from the assumptions made in generating the image. Therefore, understanding the physical basis of US image formation is critical to understanding US artifacts and thus proper image interpretation.

Artifacts have not disappeared in spite of the continuous improvement and sophistication of the ultrasound technologies. Some of the newer transducers and geometry may lead to the appearance of an elevated artifact, and can help in certain conditions.

When artifacts appear in the wrong place and time, then we expect a missed diagnosis to take place. Appropriate machine setting can be used to eliminate only some types of artifacts. Education is the best reliable defense against miss interpretation and recognition of real artifacts.

Acknowledgements.

My thanks and gratitude to all my colleagues (doctors) and all the staff in the hospital, especially the Department of Diagnostic Radiology who blunt all their efforts to extend the help and help me for the purpose of perfect work and prepare patients and advised them.My respect for all who support and advised me.

REFERENCES:

Burns PN, 1993... Doppler Ultrasound: Principles and artifacts. In ultrasound: categorical course syllabus. APPS, 281-300
Cooper berg PL. 1991. Artifacts in U.S. ultrasound Syllabus. Radiological society of North America, Inc,
David Sutton MD, FRCP, FRCR, DMRD, Fean.AR (Hon), 1994. Radiology and Imaging,
Goldsein A,and Madrazo BL1991.Slice-thickness artifacts in gray scale ultrasound J Clink Ultrasound;9:365.
KremkauFW. 2002. Diagnostic ultrasound :principles and instruments, 6th edition,pheladelphia: Saunders,

Citation: Adil Ismail Nasir.,2018. Artifact in the Image of Ultrasound.. Australian Journal of Basic and Applied Sciences, 2018, 12(12): 131-143 **DOI: 10.22587/ajbas.2018.12.12.21**
Kremkau FW, and Taylor KJW, 1996. Artifacts in ultrasound imaging. U Ultrasound Med, 5:227.

Laing FC, and Kurtz Ab. 1992; The importanve of ultrasonic side lobe artifact. Radiology 145: 763.

Larotune M, GariPYG,Dumont A, Breton G, Lapointe R. 1996; The V- shaped artifact of the gallbladder wall. AJR 147-505.

Moller N, Cooperberg PL, Rowley VA, Mayo J, and Hob. LiDKB 1994. Ultasonic refraction by the rectus abdomen's muscles: the double image artifact.J Ultrasound Med; 3:515.

Mitchell DG, 1998. Color Doppler Imaging: Principles, limitation and artifacts. Radiology; 177:1.

Middleton WD and Melson GL. 2000 The crotid ghost: A color Doppler duplication artifact. J Ultrasound Med: 487.

Patricia Ann Athey, and Frank P Hadlock. 1995. Ultrasound in obstetrics and gynecology, C.V. Mosby Company St.Louis Toronto Princeton,.

Peter Armstrong and Martin L. Wastie. 1997 Associate professor of Radiology ,,Diagnostic imaging University of Virginia Charlottesville, Virginia, USA.

Peter F.Winter,M.D. 1999. translated Ultrasound teaching ,manual Matthias Hofer,M.D. with collaboration of Tatjana Reihs, M.D. by Thieme Stuttgrat, New York,

P.E.S. 2002 palmer (university of California, Davis, California, USA) Manual of diagnostic ultrasound A.I.T.B.S Publishers and distributors (Regd) Delhi-51.

Rumack CM, Charboneau JW,and WilsonSR 1998. Diagnostic Ultrasound, 2ndediton. Philadelphia: Saunders,

Reading CC, Charbonneau JW, Allison JW. and Cooperation PL. 1999 .Color and spectral Doppler mirror Image artifact of the subclavian artery. Radiology: 174: 41.

Sauebei EE. 1995 The split image artifact in pelvis Ultrasonography Med; 4: 29.

Thick man DI, Ziskin MC, Goldenberg NJ, nda Linder BE. 1993 Clinical manifstation in parenchymal 0rgans.J Clin Ultrasound;9:133.

Ziskin MC, ThickmanDI, GoldenbergNJ, and et al. 1992. The comet-tail artifact J, ultrasound Med 1:1,