SONOGRAPHIC FINDINGS IN PATIENTS WITH NON TRAUMATIC UPPER ABDOMINAL PAIN AT SELECTED DIAGNOSTIC CENTRES, IN IBADAN, OYO STATE, NIGERIA

UGBO Johnbosco Chukwuebuka[1], ADEWUMI Olumuyiwa Femi[2]*, AKHIGBE Robert Oziegbe[1], ADEOJO Taiwo Temitope[2] , ADEUSI Henry Oluwatosin[3]
[1]Department of Radiography, Lead City University, Ibadan, Oyo State, Nigeria
[2]Physics Unit, Faculty of Physical and Chemical Science, Federal university of Health Sciences, Ila-orangun, Osun State, Nigeria.
[3]Department of Biochemistry, Federal university of Health Sciences, Ila-Orangun, Osun State, Nigeria.
*Corresponding author e-mail: olumuyiwa.adewumi@fuhsi.edu.ng
Phone number: 08032668797

Abstract
This research was aimed at evaluating the usefulness of ultrasonography in the diagnosis and management of upper abdominal pain. A retrospective study was done on sonographic findings in patients with non traumatic upper abdominal pain at Beaconhealth and Funbell diagnostic centres, Ibadan, Nigeria. A total of 236 patients that were scanned for upper abdominal pain from March, 2023 to March, 2024 were studied. The sonographic reports showed that fatty liver is the highest sonographic findings in patients with upper abdominal pain with a total number of 50 (21.18%), followed by hepatitis 36(15.25%), pyelonephritis 30(12.71%), hydrohephrosis 19(8.05%), Splenomegaly 14(5.93%), 10(4.23%) each for cholecystitis and normal studies and PUD, renal stone 8(3.38%), glomerulonephritis 7(2.96%), renal failure 4(1.69%), pancreatitis 3(1.27%), gall bladder sludge 2(0.88%), 1(0.42%) each for multiple hepatic cyst, liver mass and poly cystic kidney. It was also found that 31-35years age group was mostly affected with upper abdominal pain and 0-5 years age group was the least affected. Finally, the incidence of upper abdominal pain was greater in female than in male.

Keywords: Hydrohephrosis, Abdominal ultrasound, Abdominal pain, Glomerulonephritis, Hepatic cyst, Cholecystitis, Splenomegaly, Pyelonephritis.

1. Introduction

Abdominal ultrasound is a rapid and non-invasive method of examination of the abdomen (Mozzini et al., 2019). Abdominal ultrasound is an imaging procedure used to examine the internal organs of the abdomen including the liver, gallbladder, spleen, intestines, pancreas and kidney. The blood vessels that lead to some of these organs can also be looked at with ultrasound (Ugwuanyi et al., 2017). Abdominal pain is a leading reason for undergoing an abdominal scan. Ultrasound, being a non-invasive technique, is frequently used to investigate patients experiencing abdominal discomfort. Among these, upper abdominal pain is a particularly common complaint for those seeking medical attention(Allemann et al., 1999).Upper abdominal ultrasound can reveal many possible conditions including abdominal aortic aneurysm, abscess, cholecystitis, gall stone, hydronephrosis, kidney stones, splenomegaly and pancreatitis(Kim &Pickhardt, 2012).

For an ultrasound of the liver, gallbladder, or digestive tract, patients are typically required to fast overnight or for at least six hours before the procedure. This fasting reduces bowel gas, which can obscure the imaging, and ensures the gallbladder remains filled with bile, enhancing the visibility of its contents. For examinations of the stomach and duodenum, patients are usually instructed to drink water just before the test, as these organs are more easily visualized when filled with fluids (Sinan et al., 2003).

According to Imran (2003). Patients with upper abdominal pain represent the largest group seeking care in medical and surgical outpatient departments. After taking a patient's history and performing a clinical examination, ultrasonography is often one of the first and most effective diagnostic tools used (Jeffrey & Ralls, 1995). Upper abdominal pain, whether acute or chronic, can result from conditions affecting the liver, gallbladder, kidneys, pancreas, stomach, duodenum, spleen, pleura, pericardium, or the basal segments of the lungs (Jeffrey & Ralls, 1995; Sanders & Miner, 1998). Rare causes include aortic aneurysm and acute myocardial infarction. All these conditions have useful sonographic features which help in their diagnosis except uncomplicated peptic ulcer disease, acute myocardial infarction and based pneumonitis(Jeffrey & Ralls, 1995; Sanders & Miner, 1998).

A research done by Cyoyal (2004) showed that 82 cases for upper abdominal ultrasound were scanned. It reveal that 18 have gallstone, 4 have fatty liver, 4 have dilated common duct, 2 have thick walled gallbladder, 2 have hepatic cyst and one patient each for the following has splenomegaly, focal liver abnormalities, renal cyst, partial nephrectomy, gallbladder poly and abnormal liver texture.

In a research conducted by Mir et al., (2000) on upper abdominal ultrasound revealed the following findings, expressed as percentages of all patients: Fatty liver: 90.58%, auto-splenectomy: 55.4%, markedly reduced splenic size: 31.0%, reduced renal size: 27.1%, cholelithiasis: 25.7%, splenomegaly: 4.1% and renal enlargement: 2.78%.

The prospective study by Wibulpolprasert & Hiensiri (1999) involved 251 patients ranged 2-77 years who were hospitalized with brucellosis during a 4-years period. Patient were classified as having acute (<3 months), sub acute (3-12) months, or chronic (> 12 months) disease. Physical, laboratory and abdominal sonographic findings were analyzed. The disease was acute in 92 cases (36.7%), subacute in 48(19.1%) and chronic in 111 (44.2%). Sonographic examination of the abdomen showed enlarged periportal lymph nodes in 23 patients (9.2%), splenomegaly in 21(8.4%), hepatomegaly in 15(6%), pleural effusion in 7(2.8%), splenic abscesses in 4(1.6%), splenic cysts in 2(0.8%), acute appendicitis in 2(0.8%) and acute calculus cholecystitis in 1 patient (0.4%).

In work done by Speets (2004), abdominal ultrasound is a valuable investigation in patients with suspected of biliary pathology and in evaluating abdominal masses. Patients with localized pain and tenderness are more likely to have a positive findings on ultrasound examination than are those with defuse abdominal pain and tenderness pain ultrasound is less useful in patients who are less than 25 years of age especially when there symptoms and signs are non specific and the laboratory results are normal.

Another study done by (Raman, 2003) showed that the mean age of the patient at the time of the abdominal ultrasound was 54 years and were 35% male. 10% of the patients had a prior diagnosis of choleliathiasis and 7% had a prior cholecystectomy. Almost 80% of the patients had complaints of abdominal pain. Abnormalities with physical examination were found in 44% of the patients. The most common suspected diagnosis was cholelithiasis (47%) and nephrolithiasis (13%). Diagnostic sonography (ultrasonography) is an ultrasound-base diagnostic imaging technique used for visualizing subcutaneous body structures including tendons, muscles, joints, vessels and internal organs for possible pathology or lesions. In physics, the term "ultrasound" applies to all sound waves with a frequency above the audible range of human hearing, about 20 kHz. The frequencies used in diagnostic ultrasound are typically between 2 and 18 MHz (Díaz Agurto et al., 2024) . Ultrasonography uses a probe containing multiple acoustic transducers to send pulses of sound into a material (Case, 1998). Whenever a sound wave

encounters a material with a different density (acoustical impedance), part of the sound wave is reflected back to the probe and is detected as an echo. The time it takes for the echo to travel back to the probe is measured and used to calculate the depth of the tissue interface causing the echo. The greater the difference between acoustic impedances, the larger the echo is. If the pulse hits gases or solids, the density difference is so great that most of the acoustic energy is reflected and it becomes impossible to see deeper (Case, 1998). The frequencies used for medical imaging are generally in the range of 2 to 18MHz. Higher frequencies have a correspondingly smaller wavelength, and can be used to make sonograms with smaller details. However, the attenuation of the sound wave is increased at higher frequencies, so in order to have better penetration of deeper tissues, a lower frequency (3–5 MHz) is used (Čarovac et al., 2011).

2. Methodology

2.1 Method

This study is non-experimental retrospective research design.

2.2 Target Population

The target population includes all the patients that had ultrasound scan as a result of upper abdominal pain at Beaconhealth and Funbell diagnostic centers Ibadan, Nigeria (from March 2023– March 2024).

2.3 Sampling Technique

The convenient method of non-probability sampling technique was used. This was because all the patients folders were saved and secured.

2.4 Sample Size

A total of 236 patients data were retrieved from their sonographic reports from March 2023-March 2024. It was the period of non-interrupted machine breaks down.

2.5 Source of Data/Material For The Study

The sources of data for this study were ultrasound reports in Beaconhealth and Funbell diagnostic centers Ibadan, Nigeria.

2.6 Method of Data Collection

The data were collected from existing reports in the retrieved files. The following data were collected from the patient's reports: The patient's number, patient's sex, patient's age, ultrasound report/diagnoses.

2.7 Data Presentation and Results

The data were presented in tables to show different pathologies in different organs that were discovered in the research. Their gender distributions were also presented and their different percentages

3. Result

The data were analyzed from existing reports in the retrieved files from both centers.

Table 1: Age Distribution of Sonographic Findings in Patients With Upper Abdominal Pain (Beaconhealth Diagnostic Center.)

Age	Frequency	Percentages
0-5	1	0.90
6-10	3	2.70
11-15	8	7.21
16-20	15	13.51
21-25	22	19.82

26-30	8	7.21
31-35	14	12.61
36-40	6	5.41
41-45	9	8.11
46-50	2	1.80
51-55	2	1.80
56-60	1	0.90
61-65	5	4.50
65-70	1	0.90
Patients whose age were not recorded	14	12.61
Total	**111**	**100**

Table 1: Shows that upper abdominal pain occurs most in 21-25years age group 23(19.87%) followed by 16-20 years age group 15(13.51%)s, 14 (12.61%) for 31-35 years age group, 9(8.11) for 41-75 years age group, 8(7.21%) for 11-15 and 26-30 years age groups, each 6(5.41%) for 36-40 years age group, 5(4.50) for 61-65 years age group, 3(2.70%) for 6-10 years age group 1(0.90%) for 0-5, 56-60 and 65-70 years age group each and 14 (12.61%) for patients whose ages were not recorded in the files.

Beaconhealth Diagnostic Centers

Table 2: Organ Distribution Of Cases in Patients With Upper Abdominal Pain and Their Percentages

Organs	**Males**	**Females**	**Frequency**	**Percentages (%)**
Liver	13	31	44	39.64
Kidney	15	14	29	26.13
Gall bladder	5	10	15	13.51
Pancreas	0	0	0	0
Upper GIT	3	6	9	8.11
Spleen	0	4	4	3.60
Normal studies	6	4	10	9.01
Total	**42**	**69**	**111**	**100**

Table 2: Shows that liver has the highest pathologies 44(39.64%) followed by 29(26.15%) kidney, 15 (13.81%) gall bladder, 9(8.11%) upper GIT, 4 (3.60%) spleen and 10 (9.01%) normal studies.

Beaconhealth Diagnostic Centers

Table 3: Sonographic Findings in Non-Traumatic Patients With Upper Abdominal Pain And Their Gender Distributions

Sonographic findings	**Male(s)**	**Female (s)**	**Frequency**	**Percentage of number of cases**
Fatty liver	5	14	19	17.12

Hepatitis	7	16	23	20.72
Multiple hepatic cyst	0	2	2	1.80
Hydronephrosis	6	6	12	10.81
Glomerulonephritis	1	4	5	4.50
Renal cyst	4	3	6	5.41
Renal failure	4	0	4	3.60
Renal stone	1	0	1	0.90
Poly cystic kidney	0	1	1	0.90
Cholelithiasis	4	9	13	11.71
Cholecystitis	1	1	2	1.80
Splenomegaly	0	4	4	3.60
PUD	3	6	9	8.11
Pancreatitis	0	0	0	0.00
Normal studies	6	4	10	9.01
Total	**42**	**69**	**111**	**100**

Table 3: Shows that hepatitis is the highest sonographic findings in patients with upper abdominal pain 23(20.72%) followed by Fatty liver19 (17.12%), 13 (11.71%)cholelithiasis, 12 (10.81%) hydronephrosis, 10(9.01)normal studies 9(8.11%)PUD , 6(5.41%)renal cyst, 5(4.5%) glomerulonephritis,, 4(3.60%)each for renal failure and splenomegely, 2(1.80%)cholecystitis and 1(0.90%)each for multiple hepatic cyst, haepatoma, renal stone and poly cystic kidney.

Funbell Diagnostic Center

Table 4: Age Distribution Of Sonographic Findings in Patients With Upper Abdominal Pain.

Age	**Frequency**	**Percentages**
0-5	0	0
6-10	4	3.20
11-15	6	4.80
16-20	1	0.80
21-25	8	6.40
26-30	15	12.00
31-35	19	15.20
36-40	10	8.00
41-45	7	5.60
46-50	8	6.40
51-55	2	1.60
56-60	3	2.40
61-65	2	1.60
65-70	1	0.80
Patients whose age were not recorded	39	31.20
Total	**125**	**100**

Table 4: Shows that upper abdominal pain occurs most in 31 – 35 years age group 19(15.20%) followed by 26 – 30 years age group 15(12.00%), 10(8.00%) for 36 – 40 years age group, 8(6.40%) each for 21 – 25 and 46- 50years of age groups, 7 (5.60) for 41 -45 years age group, 6(4.80%) for 11 -15years age group, 4(3.20%) for 6 – 10 years age group, 3 (2.40%) for 56 - 60

years of group, 2(1. 60%) each for 51 – 55 and61 – 65 years of groups, 1 (0.80%) each for 16 – 20 and 65 – 70 years age groups and 39 (31.2%) for patients whose ages were not recorded in the files.

Funbell Diagnostic Centers

Table 5: Organs Distribution of Cases In Patients With Upper Abdominal Pain And Their Percentages

Organs	Males	Females	Frequency	Percentages%
Liver	22	26	48	38.40
Kidney	21	26	47	37.60
Gall bladder	7	10	17	13.60
Pancreas	1	2	3	2.40
Upper GIT	0	0	0	0
Spleen	4	6	10	8.00
Normal studies	0	0	0	0.00
Total	55	70	125	100

Table 5: Shows that liver has the highest pathologies 48(38.40%), followed by 47(37.60%) kidney, 17(13.60%) gall bladder, 10(8.00%) spleen and 3(2.40%) pancreas.

Funbell Diagnostic Center

Table 6: Sonograhic Findings in Patients with Upper Abdominal Pain and Their Gender Distribution

Sonographic findings	Male(s)	Female (s)	Frequency	Percentage of number of cases
Fatty liver	14	17	31	24.80
Hepatitis	7	6	13	10.40
Liver mass	1	0	1	0.80
Pyelonephritis	10	23	33	26.40
Hydronephrosis	6	1	7	5.60
Glomerulonephritis	1	1	2	1.60
Renal cyst	0	1	1	0.80
Renal stone	4	3	7	5.60
Cholelithiasis	3	4	7	5.60
Cholecystitis	3	5	8	6.40
Gall bladder	1	1	2	1.60
Splenomegaly	4	6	10	8.00
Pancreatitis	1	2	3	2.40
Total	**55**	**70**	**125**	**100**

Table 6: Shows that pyelonephritis is the highest sonographic findings in patients with upper abdominal pain with 33(26.40%), followed by fatty liver 31(24.80%), hepatitis 13(10.40%), splenomegaly 10(8.00%), cholecystitis 8(6.40%), 7(5.60%) each for hydronephrosis, renal stone and cholelithrasis, pencreatitis 3(2.40%), 2 (1.60%) each for glomerulonephritis and gall bladder sludge and 1(0.80%) each for liver mass and renal cyst.

Beaconhealth and Funbell Diagnostic Centers

Table7: Age Distribution of Sonograptic Findings in Non- Traumatic Patients with Upper Abonminal Pain

Age group	Frequency	Percentage (%)

0 - 5	1	0.42
6 – 10	7	2.97
11 – 15	14	5.93
16 – 20	16	6.80
12 – 25	30	12.71
26 -30	23	9.74
31- 35	33	13.98
36- 40	16	6.80
41 – 45	16	6.70
46 – 50	10	4.24
51 – 55	4	1.69
56 – 60	4	1.69
61 – 65	7	1.96
65 -70	2	0.84
Patients whose ages were not recorded in the files	53	22.45
Total	**236**	**100**

Table 7: Shows that upper abdominal pain occurs most in 31 – 33 years age group 33 (13.98%), followed by 21-25 year age group 30(12,71%), 23(9.74) for 26-30 years age group, 16-20, 36- 40 and 41-45 years age groups have 16 (6-80%) each, 53 (22.45%), 11-15 years age group,7 (2.97%) each for 6- 10 and 61-65 years age groups, whose ages were not recorded in the files 4(1.69%)each for 51-55 and 56 – 60 years age group, 2 (0.84%) for 65-70 years age group and 1(0.42%) for 0-5 years age group.

Beaconhealth And Funbell Diagnostic Centers

Table 8: Organ Distributions of Cases in Patients with Upper Abdominal Pain and Their Percentages

Organs	**Frequency**	**Percentages %**
Liver	92	38.98
kidney	76	32.20
Pancreas	3	1.27
Spleen	14	5.93
Upper GIT	9	3.81
Gall bladder	32	13.56
Normal studies	10	4.24
Total	**236**	**100**

Table 8: Shows that liver has the higher pathologies 92 (38.98%) followed by 76 (32.20%) kidney, 32(13.56%) gallbladder, 14 (5.93%) spleen, 10 (4.24%) normal studies, 9 (3.81%) upper GIT and 3 (1.27%) pancreas

Beaconhealth and Funbell Diagnostic Centers

Table 9: Organ Distribution of Cases in Gender of Patients with Upper Abdominal Pain and Their Percentages

Organs	**Males**	**Females**	**Percentage of males**	**Percentage of female**

Liver	35	57	36.08	41.01
Kidney	36	40	37.11	28.78
Pancreas	1	2	1.03	1.44
Spleen	4	10	4.12	7.19
Upper GIT	3	6	3.09	4.32
Gall bladder	12	20	12.37	14.39
Normal studies	6	4	6.19	2.88
Total	**97**	**139**	**100**	**100**

Table 9: Shows that most of these pathologies were found in females 139(58.90%) and 97(41.10%) in males. Liver pathologies dominates in female 57(41.10%) and it also dominates in male 35 (36.08%).

Beaconhealth and Funbell Diagnostic Centers

Table 10: Sonographic Findings in the Liver And Their Gender Distribution in Patients With Upper Abdominal Pain

Sonographic findings	**Male(s)**	**Female(s)**	**Frequency**	**Percentage Of number of cases**	**Percentage of males (%)**	**Percentage of females (%)**
Fatty liver	19	31	50	43.47	54.28	54.38
Hepatitis	14	22	36	39.13	40	38.59
Multiple hepatic cyst	0	2	2	2.17	0	3.51
Haemangioma	0	3	3	3.26	0	5.26
Liver mass	1	0	1	1.09	2.86	0
Total	**35**	**57**	**92**	**100**	100	100

Table 10: Shows that fatty liver is the highest sonographic findings in the liver with a total number of 40(43.47%) followed by hepatits 36(39.13%), 3(3.26%) haemangioma and 1(1.09%) for multiple hepatic cyst, hepatoma and liver mass each. A total of 92(38.98%) of the 236 findings originated from the liver, 57 were females and 35 in males.

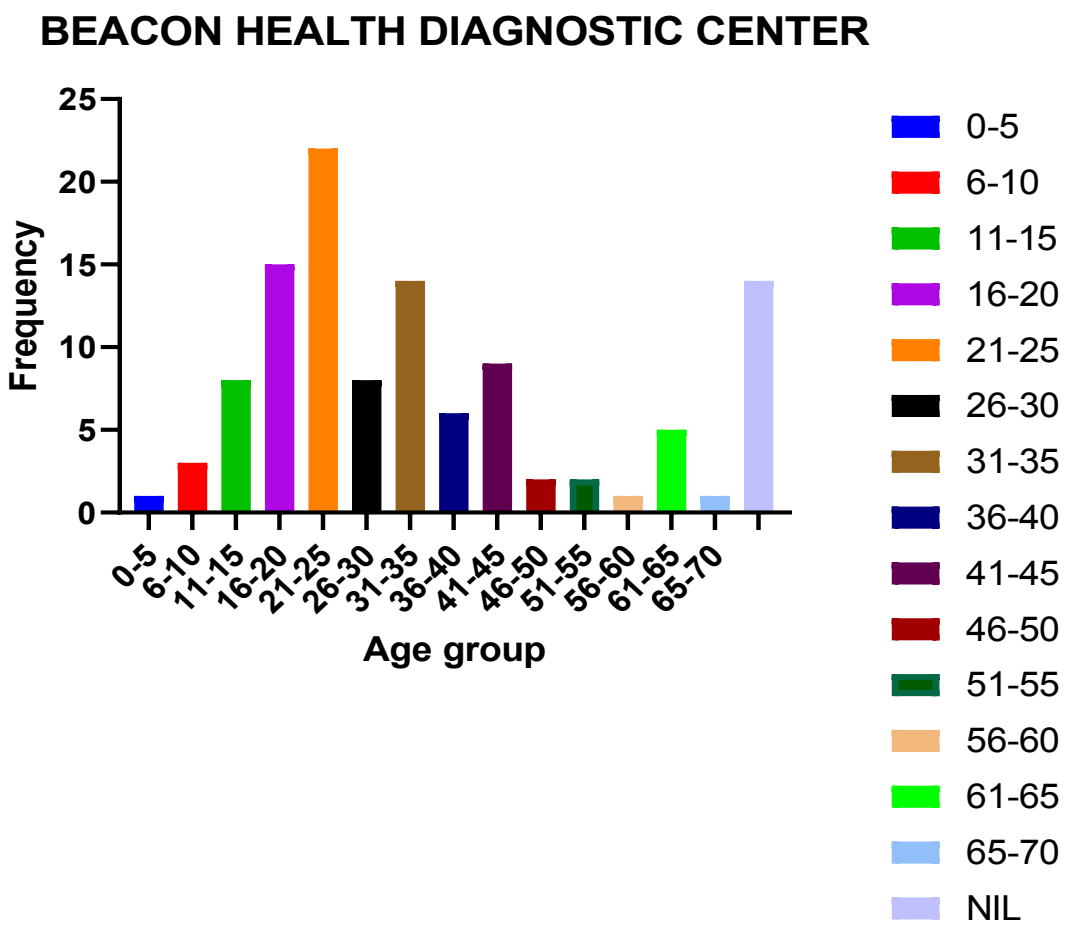

Figure 1. **Age Distribution of Sonographic Findings in Patients with Upper Abdominal Pain (Beaconhealth Diagnostic Center)**.

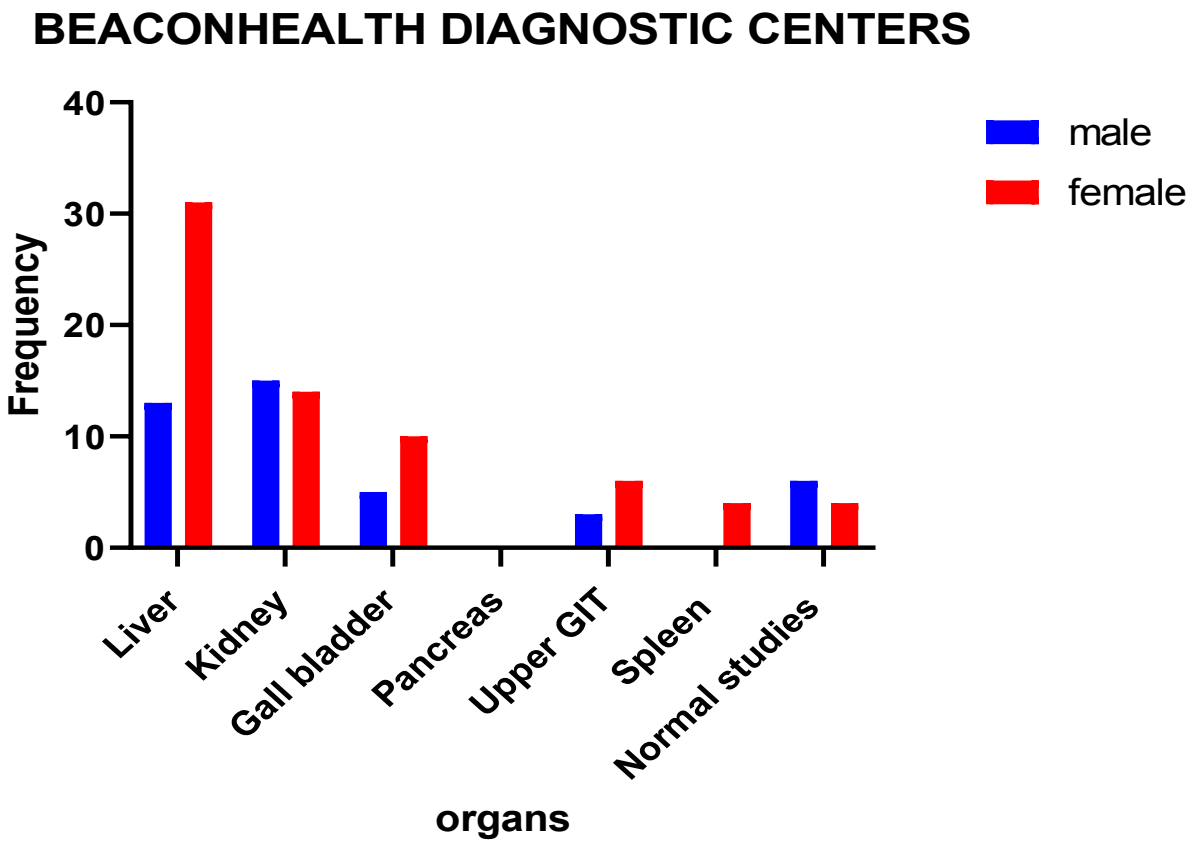

Figure 2. Organ distribution of cases in patients with upper abdominal pain and their Frequency (beaconhealth diagnostic center).

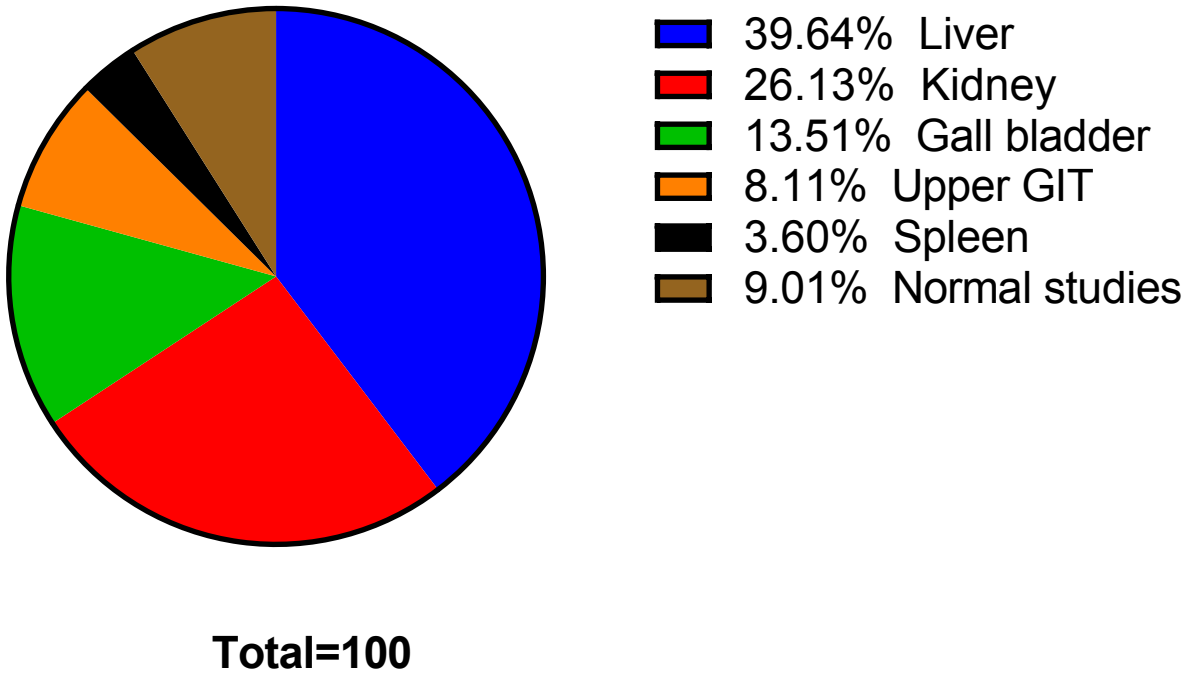

Figure 3. Organ distribution of cases in patients with upper abdominal pain and their percentage (beaconhealth diagnostic center).

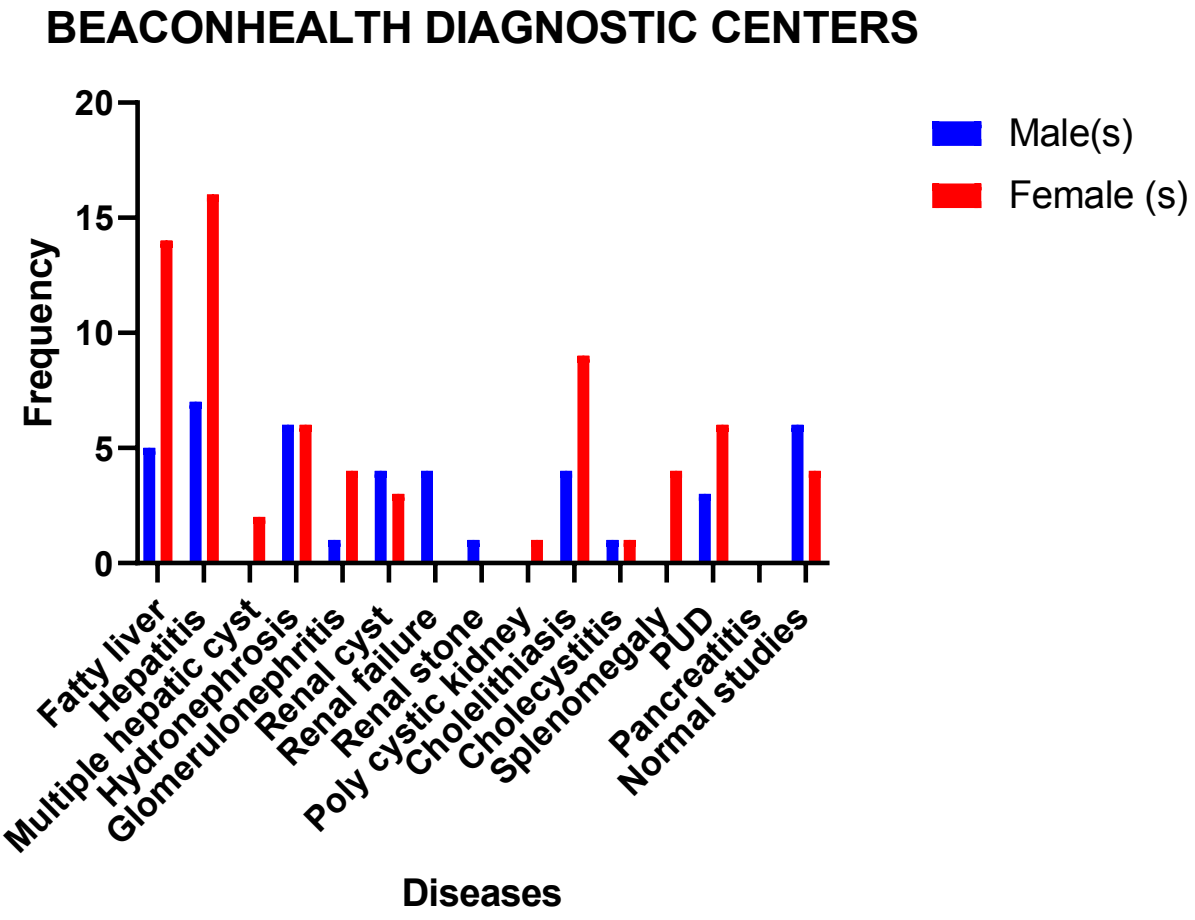

Figure 4. Sonographic findings in non-traumatic patients with upper abdominal pain and their gender distributions (beaconhealth diagnostic center).

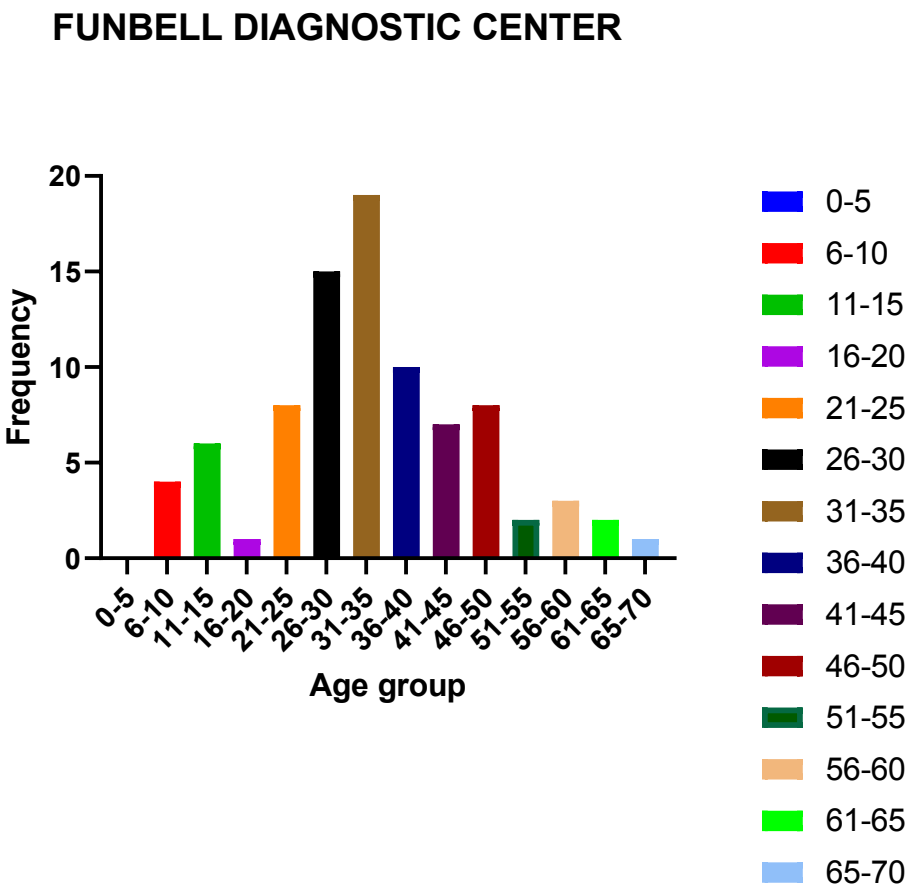

Figure 5. Distribution of sonographic findings in patients with upper abdominal pain (funbell diagnostic center)

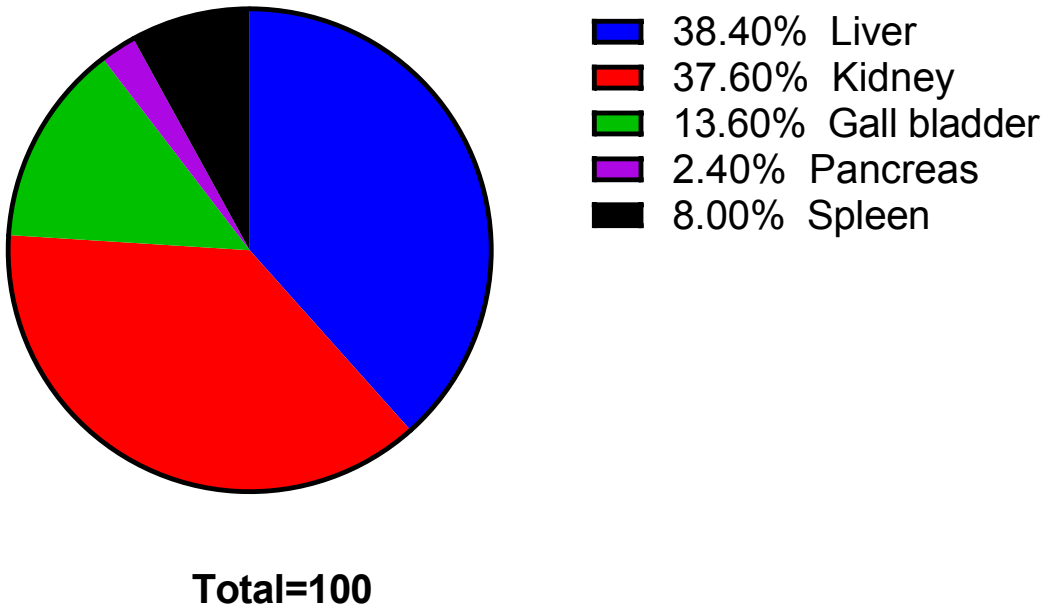

Figure 6: Organs distribution of cases in patients with upper abdominal pain and their percentages (Funbell diagnostic centers).

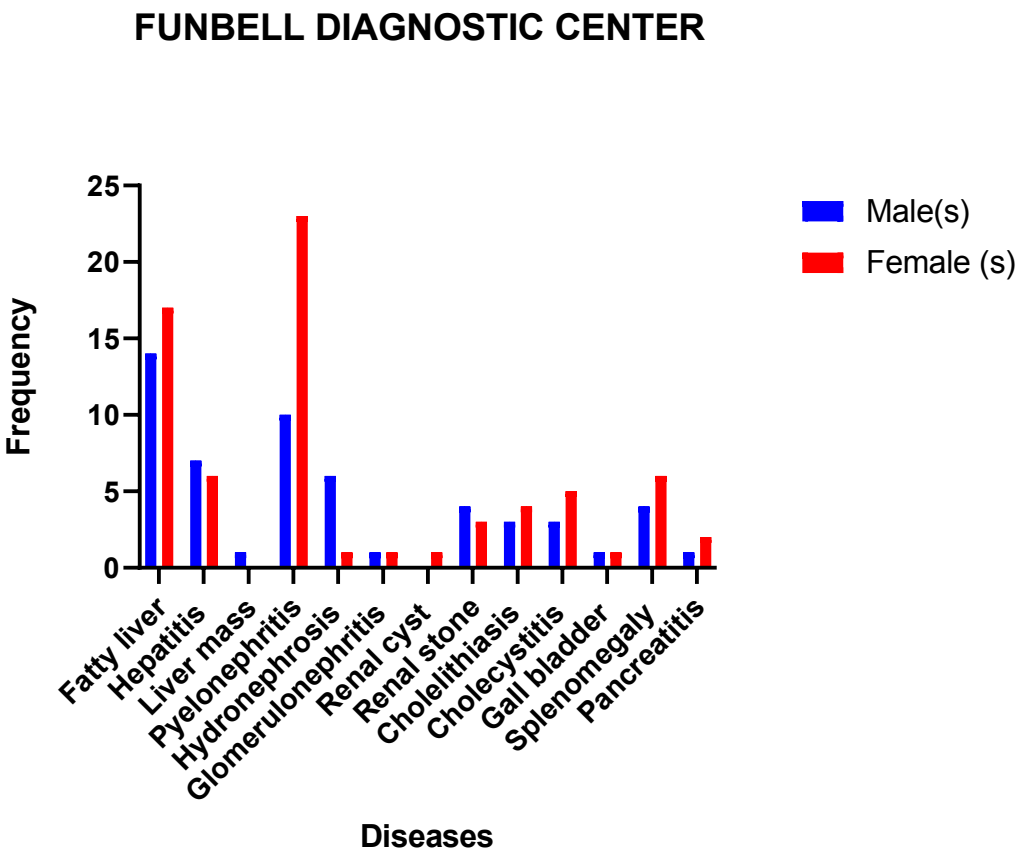

Figure 7: sonographic findings in patients with upper abdominal pain and their gender distribution

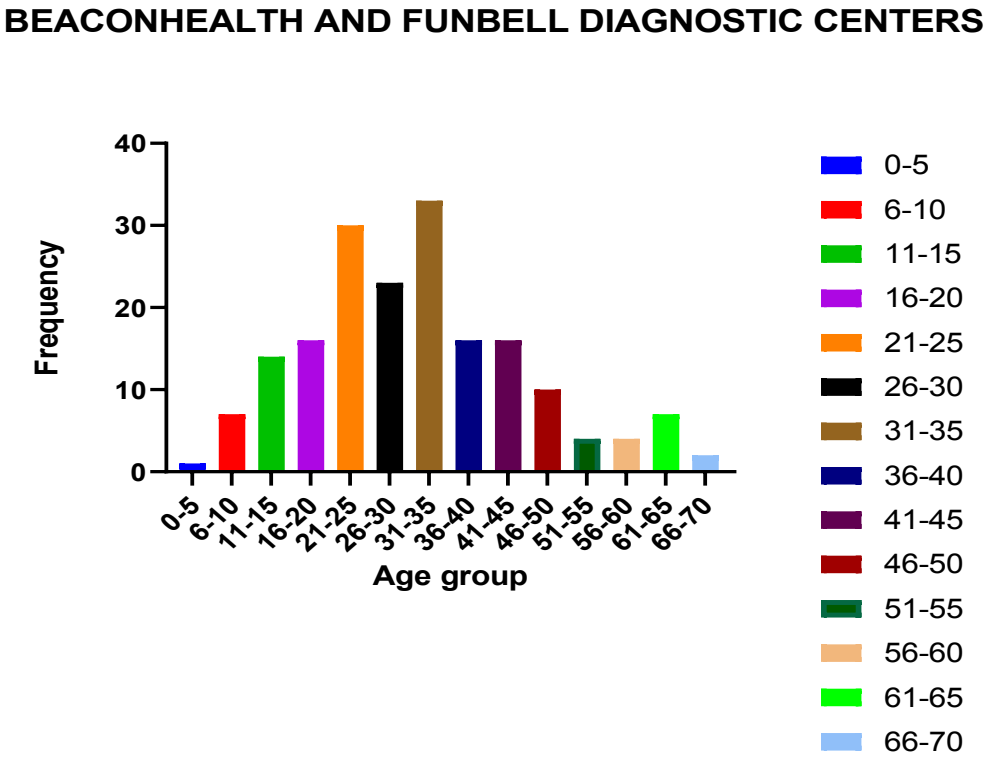

Figure 8: Age distribution of sonograptic findings in non- traumatic patients with upper abonminal pain (beaconhealth and funbell diagnostic centers)

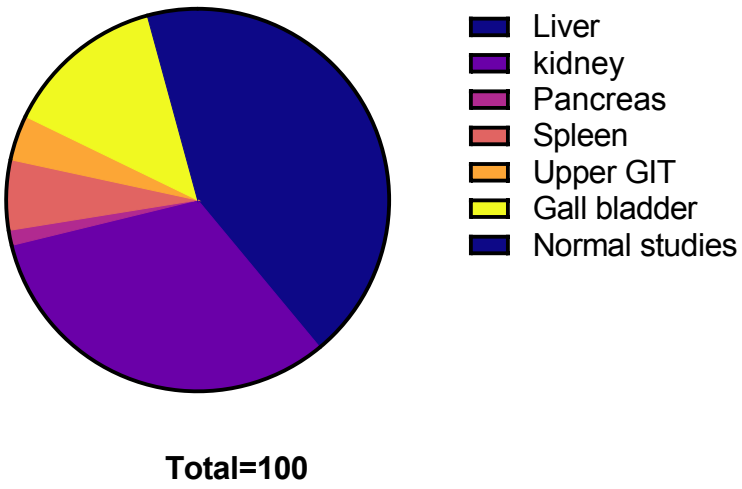

Figure 9: organ distributions of cases in patients with upper abdominal pain and their percentages (beaconhealth and funbell diagnostic centers)

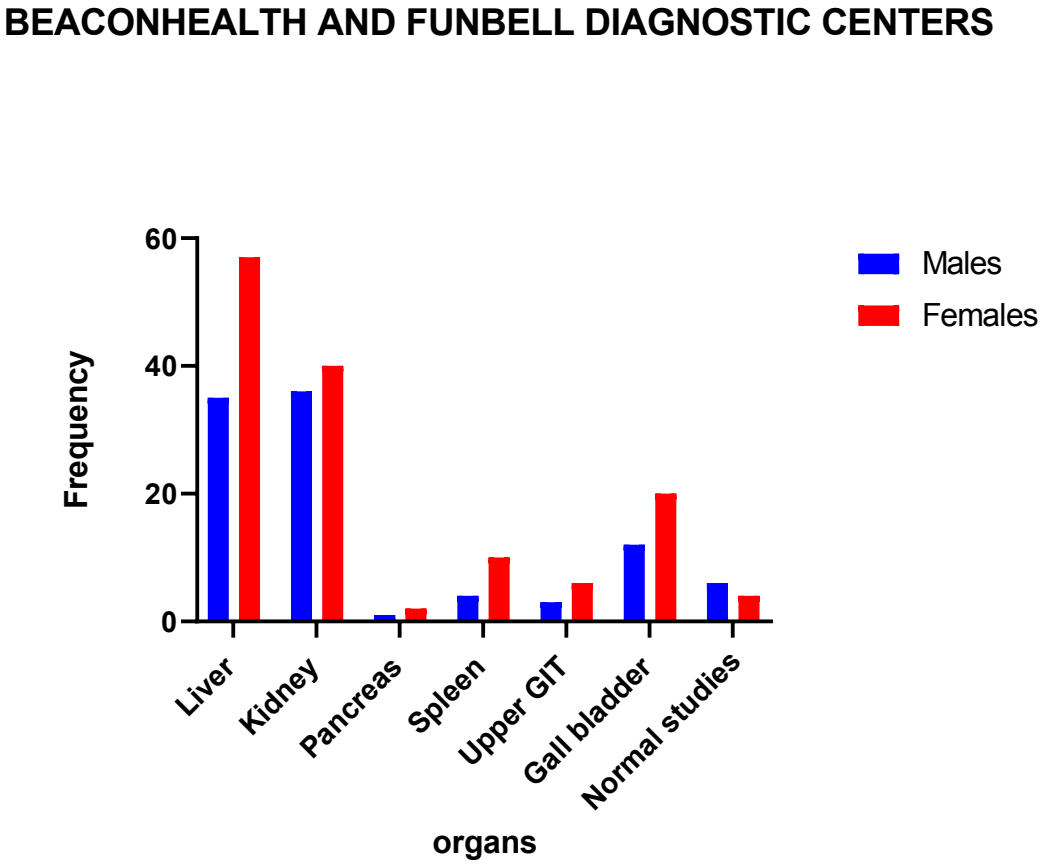

Figure 10: organ distribution of cases in gender of patients with upper abdominal pain and their percentages (beaconhealth and funbell diagnostic centers)

BEACONHEALTH AND FUNBELL DIAGNOSTIC CENTERS

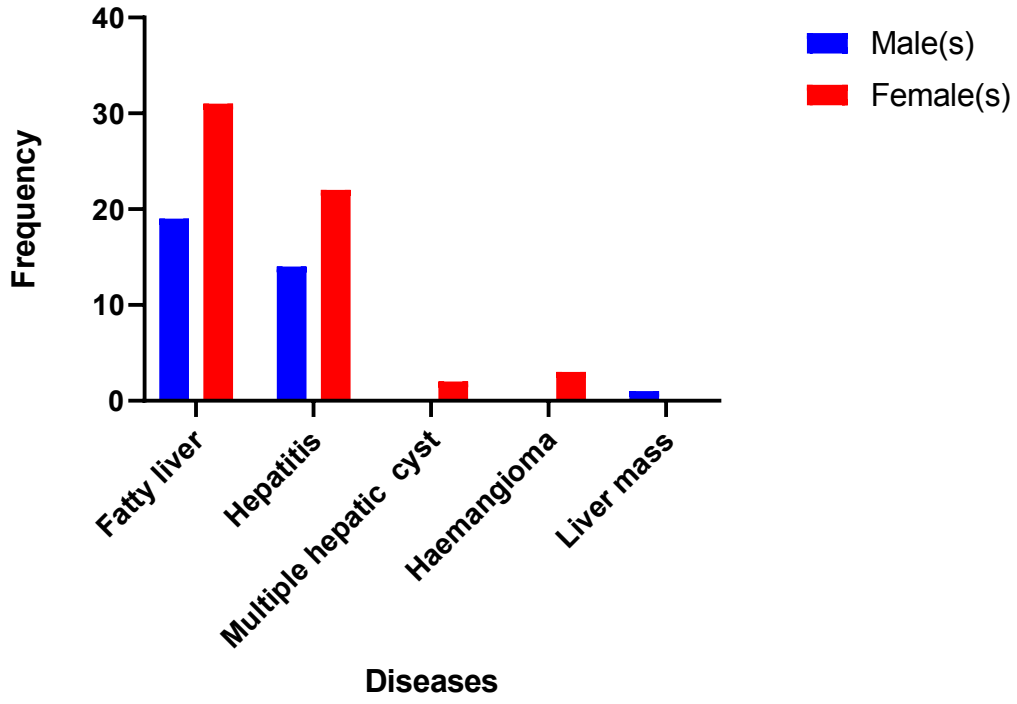

Figure 11: Sonographic findings in the liver and their gender distribution in patients with upper abdominal pain (beaconhealth and funbell diagnostic centers)

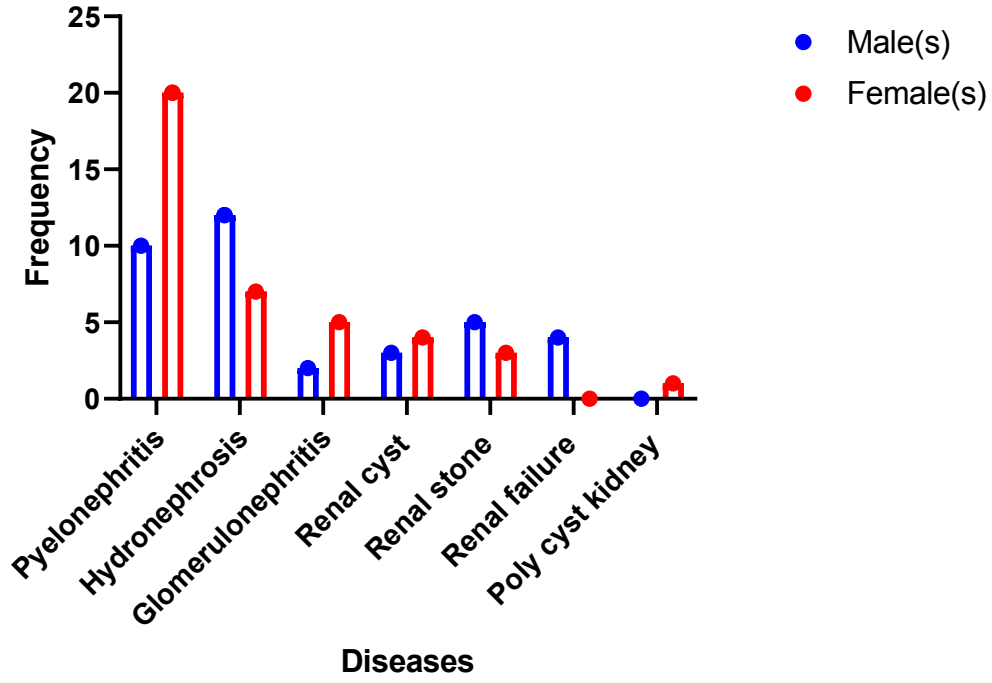

Figure 12: Sonographic findings in the kidney and their gender distributions (beaconhealth and funbell diagnostic centers)

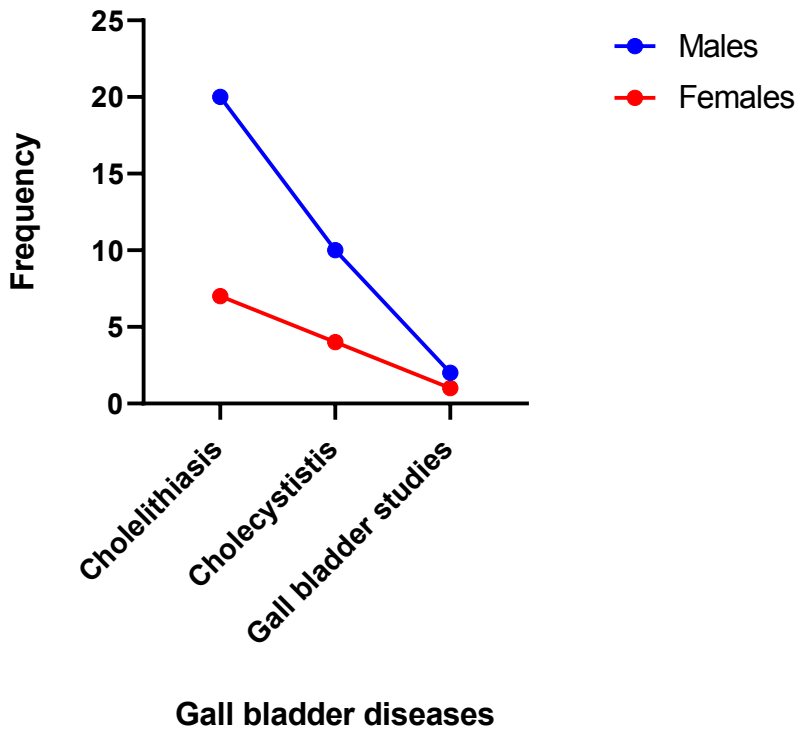

Figure 13: Sonographic finding in the gall bladder and their gender distributions (beaconhealth and funbell diagnostic centers)

BEACONHEALTH AND FUNBELL DIAGNOSTIC CENTERS

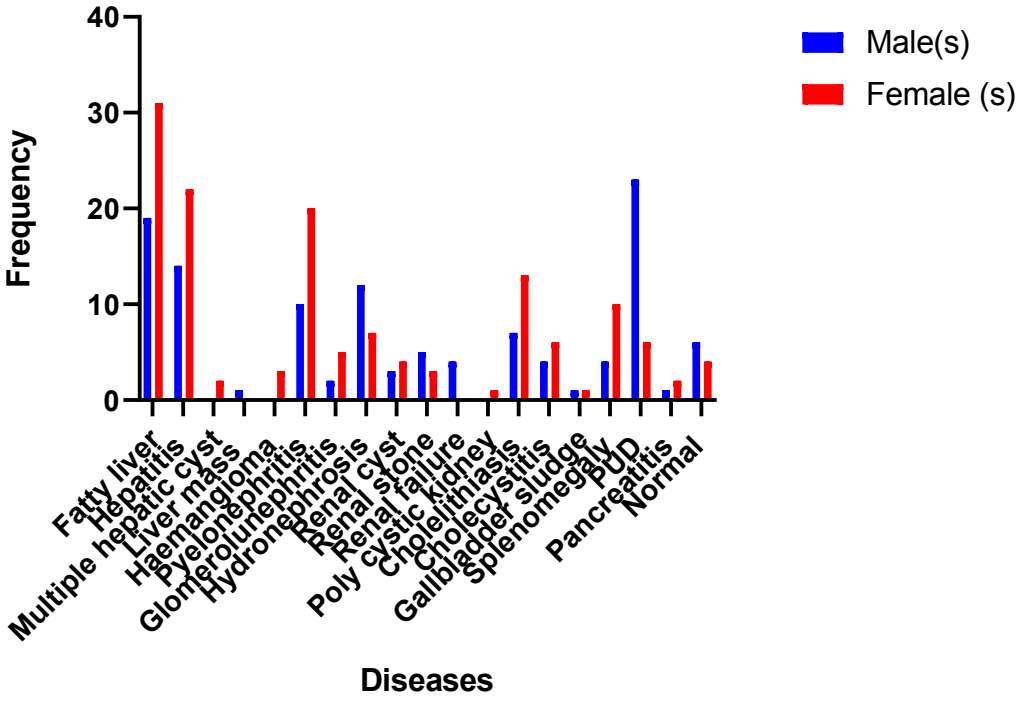

Figure 14: sonographic findings in non-traumatic patients with upper abdominal pain and their gender distributions (beaconhealth and funbell diagnostic centers)

4. DISCUSSION

It can be shown that most common findings at Beaconhealth diagnostic center were hepatitis 23(20.72%), followed by Fatty liver 19(17.12%) and cholelithiasis 13(11.71%) while at Life chart scanning centre were pyelonephritis 30(24.00%), followed by fatty liver 22(17.60%) hepatitis 13(10.40%). In general the most common findings were Fatty liver 41 (17.37%) followed by Hepatitis 36(15.25), pyelonephritis 30(12.71%), and cholelithiasis 20(8. 47%) and this is in agreement with the work done by Mir Ali et al[12]. which shows that the most common cause of upper abdominal pain was Fatty liver. It was also found that at Beaconhealth diagnostic center 21- 25 years age group were mostly affected with upper abdominal pain, followed by 16 – 20 years age group and 31 – 35 years age group while at Life chart, it were 31-35 years age group followed by 26 -30 years age group and 36 – 40 years age group. In both it were 31 – 35 years age group followed by 21 – 25 years age group and 26 – 30 years age group. This study also showed that females 139 (58 .89%) were mostly affected with upper abdominal pain than males 97(41.10%).These findings does not agree with the unpublished research done by Okike ikenna[10] which showed that 61-70 years age group were mostly affected with abdominal pain and 81-90years group were the least affected and females were mostly affected. The variability

in these results may depend on some factors like the pathology of interest, the geographical location where the scanning was done and the competency of the sonographer. The study indicates that the most common pathologies causing upper abdominal pain are fatty liver, hepatitis, pyelonephritis, and hydronephrosis. It also shows that the liver, kidneys, and gallbladder are the organs most frequently affected in these cases. The age groups most commonly experiencing upper abdominal pain are 31-35 years, 21-25 years, and 26-30 years. Additionally, the study reveals that females are more often affected by upper abdominal pain than males, and it notes a significant number of patients without recorded ages in their files.

5. CONCLUSION

In conclusion, I suggest that the use of ultrasound should be encouraged in diagnosing upper abdominal pain. It should be encouraged to be used as a first modality in diagnosis of patients with upper abdominal pain.

REFERENCES

Allemann, F., Cassina, P. C., Röthlin, M. A., &Largiadèr, F. A. (1999). Ultrasound scans done by surgeons for patients with acute abdominal pain: a prospective study. *The European Journal of Surgery = Acta Chirurgica*, *165 10*, 966–970. https://api.semanticscholar.org/CorpusID:31371452

Čarovac, A., Smajlovic, F., &Junuzovic, D. (2011). Application of Ultrasound in Medicine. *Acta Informatica Medica : AIM : Journal of the Society for Medical Informatics of Bosnia & Herzegovina : ČasopisDruštva Za MedicinskuInformatiku BiH*, *19*, 168–171. https://doi.org/10.5455/aim.2011.19.168-171

Cyoyal, M. (2004). The Correlation of Ultrasound Findings in Cases of Abdominal Pain. *Indian Head Forensic* .

Díaz Agurto, L., Contador, R., Albrecht, H., Urrutia, P., Bencze, B., Toro, M., Sáenz-Ravello, G., &Végh, D. (2024). Clinical Applications of Ultrasound Imaging in Dentistry: A comprehensive literature review. *Dentistry Review*, *4*, 100086. https://doi.org/10.1016/j.dentre.2024.100086

Hoskins, P., &McDicken, W. (1997). Colour ultrasound imaging of blood flow and tissue motion. *The British Journal of Radiology*, *70*, 878–890. https://doi.org/10.1259/bjr.70.837.9486063

Hundt, M., Wu, C., & Young, M. (2023, July 23). *Anatomy, Abdomen and Pelvis: Biliary Ducts.*StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL).

Imran, S. (2003). Accuracy of ultrasound in the diagnosis of upper abdominal pain. *Journal of Ayub Medical College, Abbottabad : JAMC*, *15*, 59–62.

Kim, D., &Pickhardt, P. (2012). Diagnostic Imaging Procedures in Gastroenterology. In *Goldman's Cecil Medicine: Twenty Fourth Edition* (Vol. 1, pp. 845–850). https://doi.org/10.1016/B978-1-4377-1604-7.00135-4

Kline, T., Zamir, M., &Ritman, E. (2011). Relating Function to Branching Geometry: A Micro-CT Study of the Hepatic Artery, Portal Vein, and Biliary Tree. *Cells, Tissues, Organs*, *194*, 431–442. https://doi.org/10.1159/000323482

Leslie, S., Sajjad, H., & Murphy, P. (2024). Renal Calculi, Nephrolithiasis. *[Updated 2024 Apr 20]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.*, *4*.

Mahatme, U., Meshram, A., Dongre, S., Nakhate, S., &Tabhane, V. (2015). Applications of Ultrasound in Medical Science: A Review. *IJSR*, 134–144.

Mozzini, C., Pesce, G., Casadei, A., Girelli, D., &Soresi, M. (2019). Ultrasound as First Line Step in Anaemia Diagnostics. *Mediterranean Journal of Hematology and Infectious Diseases*, *11*, e2019066. https://doi.org/10.4084/mjhid.2019.066

Nelwan, M. L. (2019). Schistosomiasis: Life Cycle, Diagnosis, and Control. In *Current Therapeutic Research - Clinical and Experimental* (Vol. 91, pp. 5–9). Excerpta Medica Inc. https://doi.org/10.1016/j.curtheres.2019.06.001

Okike, I. F. (2010). Analysis of Sonographic FindingsinPatientwith Abdominal pain. *A Project in Department of Medical Radiography,University of Nigeria , Enugu Campus.*, 1–50.

Raman, S. I. (2003). Are we Overusing Ultrasound in Ultrasound in Non-Traumatic Acute Abdominal Pain. . *Postgraduate Medical Journal.*

Sinan, T., Leven, H., & Sheikh, M. (2003). Is fasting a necessary preparation for abdominal ultrasound? *BMC Medical Imaging*, *3*, 1. https://doi.org/10.1186/1471-2342-3-1

Speets, A. M. (2004). *Upper Abdominal Ultrasound in General Practice: Indications, Diagnostic Field, and Consequences for Patients Management.* .

Ugwuanyi, D., Daniel, Chiegwu, H., Eze, C., &Ogbu, S. (2017). Sonographic findings in patients with upper abdominal pain in Nnewi community, Anambra State, Nigeria. *International Journal of Current Research*, *3*, 89–97. https://doi.org/10.22192/ijcrms.2017.03.06.012

Venkatakrishna, S. S., Onyango, L., Serai, S., &Viteri, B. (2023). *Kidney Anatomy and Physiology* (pp. 3–12). https://doi.org/10.1007/978-3-031-40169-5_1

Wibulpolprasert, B. and, &Hiensiri, T. D. (1999). Visceral Organ Abscesses in Melioodosis: Sonographic Findings. *J. Clin Ultrasound*.