“ROLE OF MDCT (128 SLICE SCANNER) IN ACUTE ABDOMEN”

DISSERTATION SUBMITTED TO

THE TAMIL NADU Dr. M.G.R MEDICAL UNIVERSITY, CHENNAI

IN PARTIAL FULFILLMENT OF THE REGULATIONS FOR THE

AWARD OF DEGREE OF M.D IN RADIODIAGNOSIS.

BY

DR . P. SUCHARITHA

GUIDE : DR. R. RAJA KUMAR

DEPARTMENT OF RADIOLOGY

PSG INSTITUTE OF MEDICAL SCIENCES AND RESEARCH

PEELAMEDU, COIMBATORE – 641004

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CERTIFICATE BY THE GUIDE

This is to certify that the dissertation entitled "**ROLE OF MDCT (128 SLICE) IN ACUTE ABDOMEN"** is the bonafide original work of Dr. P. Sucharitha in the department of Radiodiagnosis, PSG Institute of Medical Sciences and Research, Coimbatore in partial fulfillment of the regulations for the award of degree of M.D in Radiodiagnosis.

Signature of the guide
Dr. R. Raja Kumar D.M.R.D, D.N.B
Associate professor,
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CERTIFICATE

PSG INSTITIUTE OF MEDICAL SCIENCES AND RESEASRCH

COIMBATORE

This is to certify that the Dissertation work entitled "**ROLE OF MDCT (128 SLICE) IN ACUTE ABDOMEN**" is the bonafide work of Dr. P. Sucharitha in the department of Radiodiagnosis, PSG Institute of Medical Sciences and Research, Coimbatore in partial fulfillment of the regulations for the award of degree of M.D in Radiodiagnosis.

Dr. B.Devanand,
Professor and HOD,
Department of Radiodiadnosis,
PSG IMS & R

Dr.S. Ramalingam,
Principal,
PSG IMS & R
Coimbatore

Place : Coimbatore
Date: 24.09.16

DECLARATION

I, **Dr. P. Sucharitha** solemnly declare that the dissertation titled **"Role of MDCT in Acute abdomen"** was done by me at the department of Radiodiagnosis, PSG Institute of Medical Sciences and Research, Coimbatore during the period from December 2014 to September 2016 under the guidance and supervision of **Dr. R. Rajakumar,** Associate Professor, Department of Radio Diagnosis, PSG Institute of Medical Sciences and Research, Coimbatore. This dissertation is submitted to the Tamilnadu Dr.M.G.R. Medical University towards the partial fulfillment of the requirement for the award of M.D. Degree in Radiodiagnosis.

I have not submitted this dissertation on any previous occasion to any University for the award of any degree.

PLACE: COIMBATORE **DR. P. Sucharitha**

DATE : 24-09-2016

ACKNOWLEDGEMENT

Foremost, I would like to express my sincere gratitude to my professor and HOD Dr. B. Devanand and my guide DR. R. Raja Kumar for his ever friendly co-operation which was present throughout the preparation of this work. This work would not have been possible without his guidance, support and encouragement, Dr. B. Devanand will always be a key inspiration to me.

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I dedicate this whole dissertation and all years of hard work to my whole Family and my God Almighty.

PSG Institute of Medical Sciences & Research

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To
Dr P Sucharitha
Postgraduate
Department of Radiology
PSG IMS & R
Coimbatore

Ref: Project No. 14/398

Date: December 12, 2014

Dear Dr Sucharitha,

Institutional Human Ethics Committee, PSG IMS&R reviewed and discussed your application dated 04.12.2014 to conduct the research study entitled "*Evaluation of multi-detector row computer tomography (MDCT) in acute abdomen and its correlation with surgical and histopathological finding*" during the IHEC meeting held on 05.12.2014.

The following documents were reviewed and approved:

1. Project Submission form
2. Study protocol
3. Confidentiality statement
4. Application for waiver of consent
5. Proforma
6. Current CVs of Principal investigator, Co-investigators
7. Budget

The following members of the Institutional Human Ethics Committee (IHEC) were present at the meeting held on 05.12.2014 at IHEC Secretariat, PSG IMS & R between 10.00 am and 11.00 am:

Sl. No.	Name of the Member of IHEC	Qualification	Area of Expertise	Gender	Affiliation to the Institution Yes/No	Present at the meeting Yes/No
1	Dr. P. Sathyan (Chairperson, IHEC)	DO, DNB	Clinician (Ophthalmology)	Male	No	Yes
2	Dr. S. Bhuvaneshwari (Member-Secretary, IHEC)	MD	Clinical Pharmacology	Female	Yes	Yes
3	Dr. S.Shanthakumari	MD	Pathology, Ethicist	Female	Yes	Yes
4	Dr. D. Vijaya	M Sc, Ph D	Basic Medical Sciences (Biochemistry)	Female	Yes	Yes

The study is approved in its presented form. The decision was arrived at through consensus. Neither PI nor any of proposed study team members were present during the decision making of the IHEC. The IHEC functions in accordance with the ICH-GCP/ICMR/Schedule Y guidelines. The approval is valid until one year from the date of sanction. You may make a written request for renewal / extension of the validity, along with the submission of status report as decided by the IHEC.

PSG Institute of Medical Sciences & Research
Institutional Human Ethics Committee

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Following points must be noted:

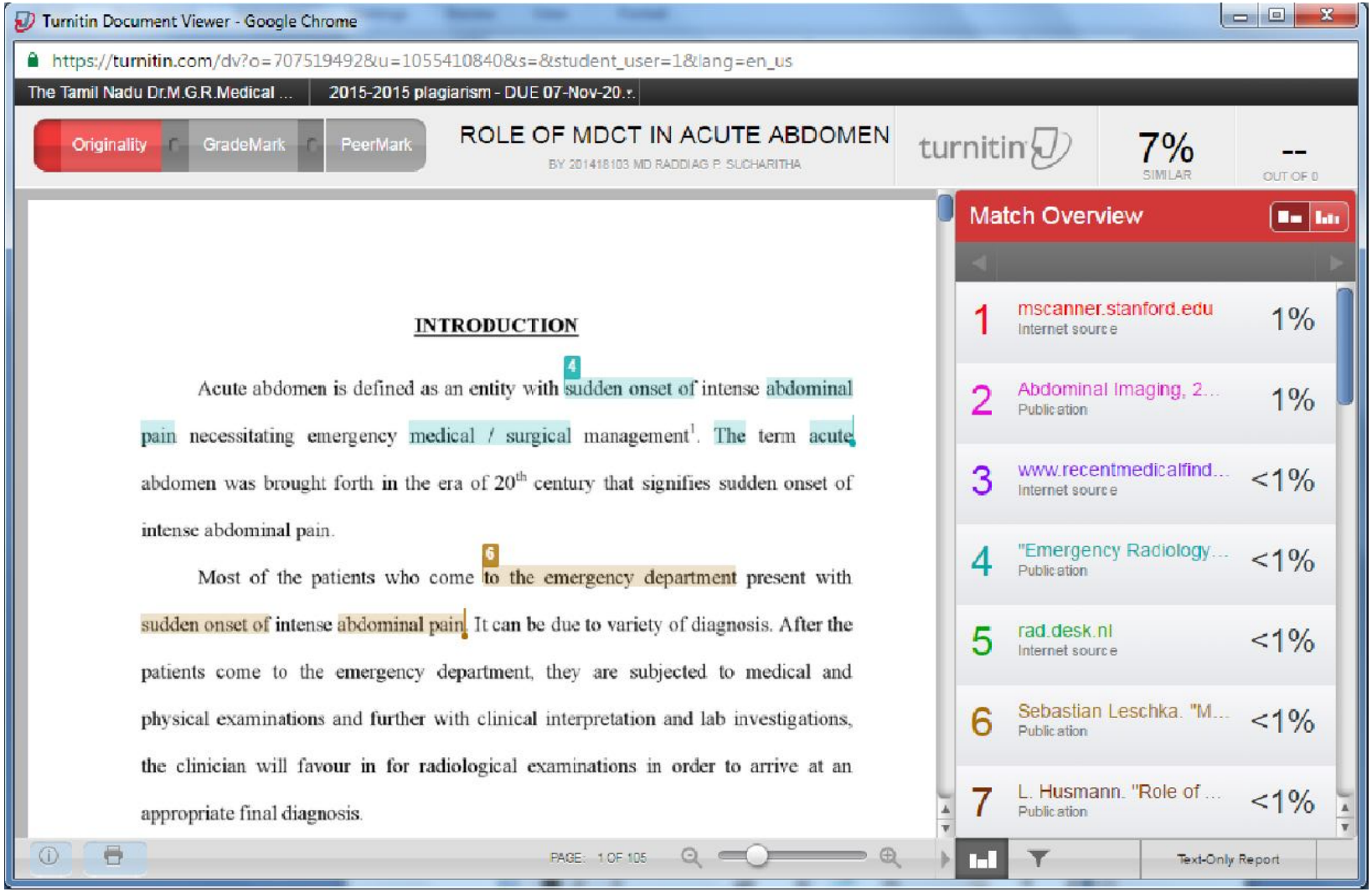
1. IHEC should be informed of the date of initiation of the study
2. Status report of the study should be submitted to the IHEC every 12 months
3. PI and other investigators should co-operate fully with IHEC, who will monitor the trial from time to time
4. At the time of PI's retirement/intention to leave the institute, study responsibility should be transferred to a colleague after obtaining clearance from HOD, Status report, including accounts details should be submitted to IHEC and extramural sponsors
5. In case of any new information or any SAE, which could affect any study, must be informed to IHEC and sponsors. The PI should report SAEs occurred for IHEC approved studies within 7 days of the occurrence of the SAE. If the SAE is 'Death', the IHEC Secretariat will receive the SAE reporting form within 24 hours of the occurrence
6. In the event of any protocol amendments, IHEC must be informed and the amendments should be highlighted in clear terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. Alteration in the budgetary status should be clearly indicated and the revised budget form should be submitted
   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval
   d. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented
   e. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IHEC and only then can they be implemented
   f. Any deviation-Violation/waiver in the protocol must be informed to the IHEC within the stipulated period for review
7. Final report along with summary of findings and presentations/publications if any on closure of the study should be submitted to IHEC

Kindly note this approval is subject to ratification in the forthcoming full board review meeting of the IHEC.

Thanking You,

Yours Sincerely,

Dr S Bhuvaneshwari
Member-Secretary
Institutional Human Ethics Committee



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ABSTRACT

AIM

- To evaluate the accuracy of MDCT (128 slices) in the diagnosis of acute abdomen
- To assess the efficacy of MDCT in differentiating the various pathological causes of acute abdomen.
- To explore the sensitivity and specificity of MDCT in acute abdomen cases with intra-operative surgical finding/ histopathological findings/ clinical findings as reference standards.

MATERIALS AND METHODS

Prospective study on 73 subjects with acute pain abdomen was subjected to MDCT. MDCT was done with **SIEMENS SOMATOM DEFINITION EDGE 128 SLICE SCANNER**. The radiological findings at CT were compared with those at surgery/ clinical finding and with the available histopathological results to verify the efficacy of 128-slice MDCT in the preoperative evaluation of the acute abdomen cases.

RESULT

In our study the sensitivity of MDCT was 97.10% and specificity was 75%. The overall Positive Predictable Value was 98.53% and negative predictive value was 60% and accuracy rate was 95.89%.

CONCLUSION

We conclude that MDCT has high accuracy and sensitivity. In clinically inconclusive cases of acute abdomen, the consultant will favor for MDCT in order to arrive at an appropriate provisional diagnosis. The results obtained in the study were comparable to pioneer studies conducted worldwide. However major limitation was small sample size.

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INTRODUCTION

Acute abdomen is defined as an entity with sudden onset of intense abdominal pain necessitating emergency medical / surgical management[1]. The term acute abdomen was brought forth in the era of 20th century that signifies sudden onset of intense abdominal pain.

Most of the patients who come to the emergency department present with sudden onset of intense abdominal pain. It can be due to variety of diagnosis. After the patients come to the emergency department, they are subjected to medical and physical examinations and further with clinical interpretation and lab investigations, the clinician will favour in for radiological examinations in order to arrive at an appropriate final diagnosis.

In order to decrease the mortality rate and morbidity rate, an efficient and correct diagnosis should be given for these patients[2]. This may be challenging because, the clinical examination is tough, and investigations, like plain radiograph of the abdomen and USG examinations are usually inconclusive.

In such cases,

1. Multi-Detector Computer Tomography MDCT is a widely accepted primary investigation of choice in patients coming with intense abdominal Pain.[3-5]
2. It is the most rapid, specific, time efficient, objective and informative imaging technique.
3. With the advanced technology of MDCT, multiple images can be acquired in a single tube rotation. The whole abdomen and pelvis can

be scanned within a single breath hold at a thickness of sub-millimeter (0.5 to 0.75mm) in the 3D plane. These data sets result in voxels that are both sub millimeter in dimension and isotropic, suggesting that reformations in any desired plane will have a spatial resolution similar to that of the axial plane**.**

4. MDCT provides a global judgment of the gastrointestinal tract, mesenteries, solid organs, peritoneum and retroperitoneal areas.
5. It also gives us clear data for another possible diagnosis, if the working clinical diagnosis is incorrect and has a significant outcome in the treatment of patients with intense abdominal pain.
6. With the introduction of multi planner reconstruction in the workstations, MDCT has led to a great improvement in the management of these patients.

Our study aims at assessing the accuracy of 128 slice multi-detector Computer Tomography (MDCT) in the diagnosis and pre-operative evaluation, in subjects who present with intense pain abdomen with intra-operative surgical findings / histopathological results and clinically follow up is done for patients those who are conservatively managed. Some of the frequently encountered conditions are appendicitis, diverticulitis, inflamed gallbladder, perforated viscus, ischemic bowel disease, bowel obstruction and many more. So, role of Imaging in these conditions are of paramount importance for the timely diagnosis.

Aim:

- To evaluate the accuracy of MDCT (128 slices) in the diagnosis of acute abdomen
- To assess the efficacy of MDCT in differentiating the various pathological causes of acute abdomen.
- To explore the sensitivity and specificity of MDCT in acute abdomen cases with intra-operative surgical finding/ histopathological findings/ clinical findings as reference standards.

Objective:

Primary objective:

- Analyze the effectiveness of MDCT in evaluating the various underlying pathologies in acute abdomen.

Secondary objective:

- Document the sensitivity & specificity of MDCT as a diagnostic tool.
- Correlate MDCT imaging findings with surgical/ histopathological findings/ clinical findings
- The incidence of different pathologies presenting as acute abdomen in a tertiary care hospital.

MATERIALS AND METHODS

Prospective study on 73 subjects with acute pain abdomen was subjected to MDCT. MDCT was done with **SIEMENS SOMATOM DEFINITION EDGE 128 SLICE SCANNER**. The radiological findings at CT were compared with those at surgery/ clinical finding and with the available histopathological results to verify the efficacy of 128-slice MDCT in the preoperative evaluation of the acute abdomen cases.

The duration of this study was from May 2015 to June 2016

Inclusion criteria:

- Patients who are presenting with clinical symptoms of acute abdomen and undergoing MDCT.

Exclusion criteria:

- Patients who have contraindication to contrast media in whom contrast study are indicated.
- Patients lost to follow up.

Study Protocol

Application of contrast agent:

Contrast application is adjusted based on the provisional diagnosis. Oral, IV and rectal contrast is given in inconclusive cases. Exceptions for oral contrast are high-degree bowel obstruction, acute bleed and acute pancreatitis. In cases like ischemic bowel disease and gastro intestinal bleed, CT angiography plays a vital role. In acute severe cases where oral contrast transit time (60 minutes) may not be possible, such cases are avoided from oral contrast. Rectal enema facilitates rectal contrast when needed.

MDCT Technique:

Patient in supine position with arms raised above the head and the abdomen is centred within the gantry. Non-enhanced CT (NECT) abdomen was done from the level of diaphragm through the symphysis pubis within a single breath hold. The kVp and mAs parameters were automatically controlled by the machine; raw data are acquired at a section thickness of 0.625 mm; pitch – 0.8 to 1.5. First, the images are acquired in pre-contrast phase. Then, 1-2ml per kg of water soluble non-ionic IV contrast medium with an iodine content of 275 to 370mg was given at a rate - 4ml/sec through a power injector. Then, post- contrast arterial, venous and delayed phases were taken at 25secs, 45secs and 7mins respectively by bolus tracking and automated triggering technology. In necessary cases, oral contrast was given an hour prior to the procedure, 30ml ionic contrast medium containing 250mg I/ml in 1litre of water.

Image processing and analysis:

After acquiring the source images, volumetric reconstructions were performed from the raw data in the workstation. The raw data sets were then reconstructed into 5mm and 1mm thickness for viewing the images and reconstruction purposes respectively. These included coronal and sagittal reformations. Thin MIP as well as 3D reconstructions are done as and when needed, depending on the provisional diagnosis.

Usefulness of reformation arts:

The axial images taken in multi detector CT are reconstructed into Multiplanar views in any plane as needed by the interpreter. The large volume of data can be manipulated into any desired plane by multiplanar reconstruction techniques in workstations. MPR in coronal reconstructions acts as compliment to the axial plane in the detection and confirmation of pathology in patients with intense pain abdomen.[6] Various pathologies of tubular structures like bowel, vessels and ureter are best delineated by using multiplanar reconstructions.

Maximum Intensity Projection (MIP):

The structures which are lying in two or more planes can be evaluated using high attenuation values throughout the volume into a 2D image like CT angiography and Urography. The main limiting factor is the bones which obscure the adjacent vessels.

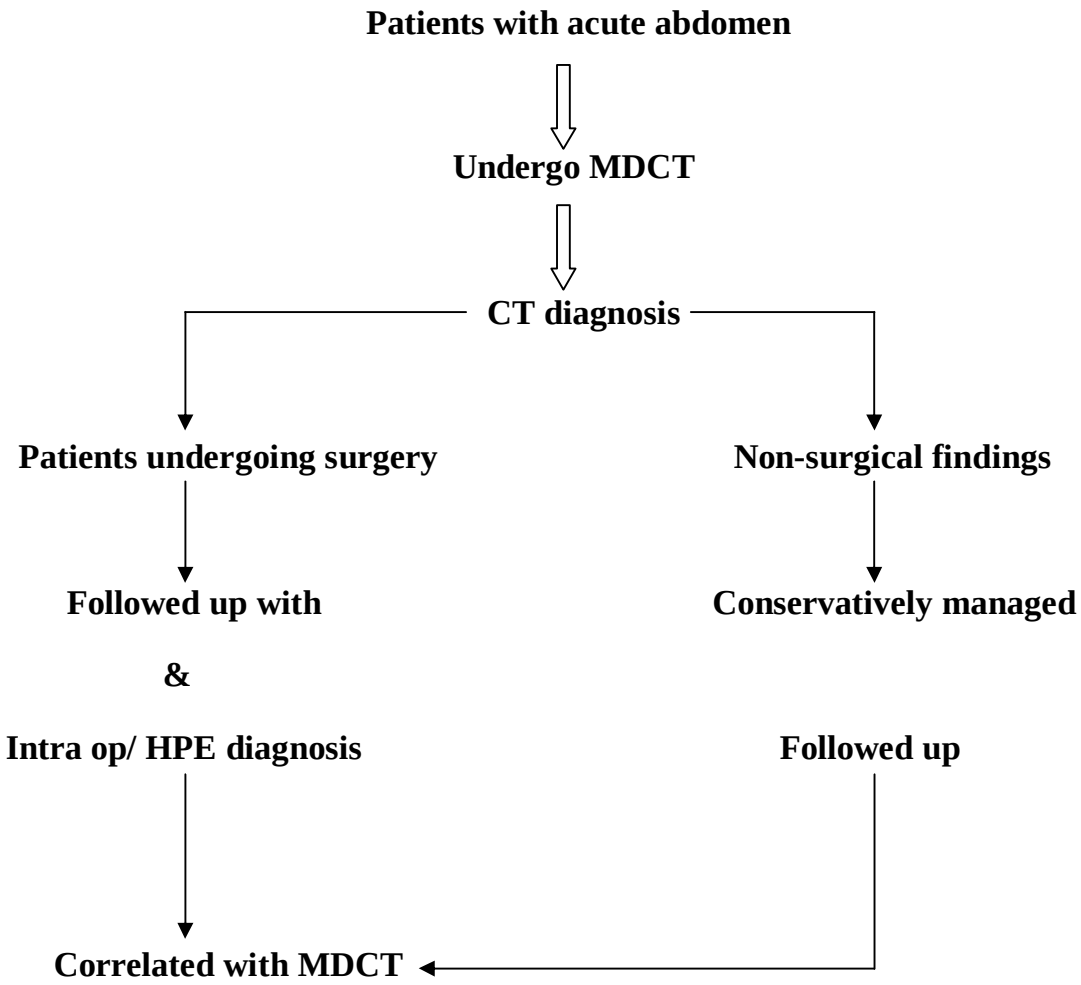
Volume rendered technique (VRT) images are effectively useful for comparing of intricate anatomy and complicated pathological changes in abdominal organ perfusion that has a twisted minute branches along with comparison of MPR or

axial images. These post-processing techniques are done on a dedicated workstation for interactive viewing.

Data analysis:

With the CT diagnosis, patients undergoing surgery are correlated with intra-operative surgical findings and histopathological findings if available. In non-surgical patients those who are conservatively managed are followed up for clinical recovery and correlated with MDCT findings.

Study Design:



REVIEW OF LITERATURE

Monica Mangini et al[7] compared the role of MDCT findings with intraoperative surgical findings and histopathological results in 57 pain abdomen subjects. She found that 47 out of 57 cases were totally concordant with MDCT and final discharge diagnosis depending on the intraoperative surgical findings and histopathological results. 10 out of 57 cases were partially discordant and none of the cases were completely discordant. The MDCT sensitivity for this study was 82.4%.

MDCT acts as a very important decisive tool in the treatment of acute abdominal patients allowing an accurate and rapid provisional diagnosis.[7]

Rao PM et al[8] determined the signs of acute appendicitis in helical CT and statistically analysed the sensitivity and specificity values in 200 cases (100 appendicitis and 100 normal appendix cases), shown to have high sensitivities and specificities ranging from 91–100% and 91–99%, respectively for CT in the diagnosis of appendicitis.

Among the individual CT signs identified, enlarged (> 6 mm) unopacified appendix has got the high sensitivity and specificity of 93% and 100% respectively followed by 100% and 80% for surrounding fat stranding.

Rectal and per oral contrast delineates accurately differential diagnosis more than four fifth of cases.[8]

Wong SK et al[9] did a prospective study in 50 patients who were clinically diagnosed to have appendicitis before surgery, with thin-collimation helical CT. This yielded an accuracy of 94%, sensitivity of 95%, specificity of 92%, and positive predictive value of 97% and negative predictive value of 86%. The appendix was identified in 45 patients (90%) and obscured by an inflammatory mass in the remaining five.

Helical CT with rectal contrast medium is a quick, well tolerated and accurate test for diagnosing appendicitis. It can offer alternative, possibly non-surgical diagnosis in patients who would otherwise have undergone laparotomy[9].

Bendeck SE et al[10] retrospectively demonstrated the sensitivity and positive predictive value of CT and US in 313 patients and it was found that ultrasound is less sensitive than CT in patients with atypical right iliac fossa pain**.** The sensitivity values for CT and USG were 93% and 77% and positive predictive value exceeded 93%.

Erik K. Paulson et al[11] stated that although axial CT performed with IV and oral contrast agents is sensitive and specific for acute appendicitis, there are patients in whom the diagnosis may be difficult or in doubt. For example, identifying the appendix may be difficult in cases, where there is decreased fat content within the peritoneal cavity, posterior position of the appendix, in cases with less than the optimum opacification of the distal ileum, or when the appendix is near the adnexa within the pelvic cavity. In such patients, coronal imaging may

provide improved appendiceal visualization and enhances the confidence as to the presence or absence of acute appendicitis.

Suri S et al[12] performed a prospective study in 32 patients of suspected small bowel obstruction by comparing the efficacies of conventional radiography, USG and CT. These 32 patients were evaluated for the existence of obstruction, obstruction level and the aetiology for obstruction. The CT diagnosis were then compared with intraoperative surgical finding or by following up clinically in those who are conservatively managed.

Among the 32 subjects, 30 were evaluated as mechanical cause of intestinal obstruction. Of which 22 were diagnosed as small bowel obstruction and 8 were diagnosed to have large bowel obstruction. Among the 2 left out cases, 1 was confirmed as adynamic ileus and the other was diagnosed as mesenteric cyst. The sensitivity, specificity and accuracy of CT for the existence of obstruction in this study came out as 93%, 100% and 94% respectively. Likewise sensitivity, specificity and accuracy rate for USG and conventional radiography were 83%, 100%, 84% and 77%, 50%, 75% respectively. The obstruction level for CT, USG and conventional radiography were 93%, 70% and 60% respectively. The percentage of determining the cause for obstruction for CT, USG and conventional radiography were 87%, 23% and 7% respectively.

Finally CT proved to be a efficient and correct imaging modality of choice in determining the existence, level and aetiology of obstruction when compared to USG and conventional radiography.

Megibow AJ et al[12] reviewed CT for 84 patients who were referred for small bowel obstruction. These findings were confirmed with intraoperative surgical findings in 39 subjects, by barium examination in 17 subjects and by clinical follow-up in 28 subjects. Total number of cases that were identified with intestinal obstruction was 64 patients. The various aetiologies of obstruction for these cases were colonic diverticulitis in 2, adhesions in 37, Crohn's disease in 4, primary tumour in 7, hernia in 3, metastases in 6, and hematoma in 2 and others 3. Simultaneously another set of 83 patients were subjected to CT for the evaluation of intestinal obstruction, in which there were no underlying cause or history of obstruction. The sensitivity, specificity and accuracy rate for this study came around 94%, 96% and 95% respectively. The various aetiologies of obstruction were accurately evaluated in 47 out of 64 cases with rate of 73%.

Bowel obstruction is a frequent cause of abdominal pain and accounts for 20% of all surgical admissions.

Peck et al[14] evaluated 55 cases for the possibility of small bowel obstruction by comparing both CT and barium follow through. On comparison the sensitivity for both CT and barium follow through was 90% and 50% and specificities were similar for both which was around 57%.

CT was precise in evaluating partial high-grade and complete small bowel obstruction. But when CT findings are inconclusive barium meal follow through plays a dominant role in the identification of low grade partial obstruction which was studied in 6 patients with good accuracy rate from 81% to 93%.[14]

Finally they concluded that CT to be more superior than barium meal follow through in identifying the aetiology of obstruction.

Durgesh Kumar Saini et al[15] 2013, evaluated the superiority of MDCT prospectively in 40 cases of suspected small bowel obstruction to the traditional clinical-radiographic findings. Sensitivity of 85% and specificity of 70% for MDCT were analysed in this study.

Mallo et al[16] (2005) reviewed the sensitivity and specificity of MDCT in the evaluation of obstructed bowel ranging from 81% to 100% and 68% to 100% respectively.

In various other studies the sensitivity and specificity for the evaluation of bowel obstruction by MDCT were recorded as 94% and 96% correspondingly. This disparity may be due to selection of patients based on high grade obstruction. In case of low grade obstruction, the presence of mild and focal dilation of bowel loops may be unnoticed which negatively affects the identification of sensitivity and specificity of bowel obstruction by using MDCT. So in such cases these minute findings should be considered which may add up the accuracy rates in diagnosing bowel obstruction by using MDCT.[15]

Durgesh Kumar Saini et al[15] stated that MDCT is a great imaging modality of choice in evaluating the existence, level and the aetiology of bowel obstruction by analysing the sensitivity and specificity rates. MDCT has proved to be a highly sensitive tool in the evaluation of high grade partial obstruction and complete bowel obstruction. Those patients with low grade partial obstructions

are followed up for clinical recovery. When plain radiography remains inconclusive and in cases of suspected strangulation and obstructed bowel MDCT plays a vital role in defining the diagnosis. So patients' outcome gets improved with an accurate diagnosis of bowel obstruction by using MDCT.

Ha HK et al[17] evaluated the usefulness of CT for the differentiation of simple (n = 43) and strangulated (n = 41) small-bowel obstructions in 84 patients caused by adhesions, hernia, and volvulus, who were reviewed retrospectively. Diagnoses were made with surgery (n = 55) and during clinical follow-up (n = 29). CT findings detected 100% specificity for detection of strangulated obstructions with absence or poor of bowel wall enhancement.

CT illustrates the various stages of acute pancreatitis using CT severe index score.[18]

The sensitivity, specificity and accuracy rates were 100%, 100% and 87% for the identification of more than half of the pancreatic necrosis. The sensitivity was around 50% for minor necrotic areas at surgery. False positive rates for detection of acute pancreatitis were not present for CT scans.[19]

Balthazar EJ et al[20] stated based on the revised Atlanta classification. For acutely ill patients CECT acts as an accurate and initial imaging modality of choice for determining the criteria based on images. Gallstones and alcohol abuse are the most common causes of acute pancreatitis, accounting for 80% of cases.

In order to evaluate the morphology of pancreas, analyse the necrosis of pancreas and to find out the retroperitoneal complications MDCT scanning with bolus IV contrast is done. In this population CT Severity Index (CTSI) serves as a good indicator of disease severity when concerned with the risk of death and with the progress of systemic and local problems. Also MDCT serves as a useful tool in following up of these patients for clinical recovery.[20]

CECT is not indicative for those patients with negative signs of acute pancreatitis and in those who clinically improve. The optimal time for evaluating the complications of acute pancreatitis is after 72 hours. In the setting of fever, deranged blood levels or in case of septic shock repetition of CT is recommended. CT serves as a useful interventional tool in catheter placement for drainage and evaluates good recovery of the patients.

In cases of moderate to severe pancreatitis CT serves as a highly sensitive and reasonable tool against very mild cases of acute pancreatitis. CECT also serves to identify other causes of acute abdomen if the patient's symptoms are related to acute pancreatitis.[20]

The use of post processing techniques makes MDCT a definitive tool for assessing the extent of the disease. VRT serves as a valuable technique for assessing the complications like pseudo cysts and its relationship with adjacent organ, venous thrombosis, pseudo aneurysms of splenic artery, and collateralization.[20] The intricate anatomical relationship of pancreatic ducts and vessels are very well delineated by using curved planar reconstructions.[21]

MDCT protocol included unenhanced (NECT) and post-contrast study in the "pancreatic phase" (40 sec), portal phase (70 sec) and late phase (180 sec). NECT scans were useful to detect calcified gallstones. Enhanced CT exam was always performed to detect the extent of necrosis (extension <30%, 30-50% and > 50%) and whether or not superimposed infection is present, to depict vascular and loco regional complications. It is critical to identify patients who are at high risk for severe disease, since they require close monitoring and possible intervention.[22]

Imaging appearances based on the severity: CT severity index is calculated based on imaging appearance of pancreatitis, which shows uniform enlargement of the pancreas with surrounding thick fluid collection. In mild forms up to one third of the patients CT may not illustrate any pathology.[23] In severe necrotising cases, clear areas of normal and necrotic parenchyma are delineated and the extent and presence of collections are also well delineated. Peripancreatic exudates spread through fascial planes into surrounding organs.

Imuta M et al[24] reviewed 44/155 patients, for the presence as well as the level of gastro intestinal perforation with the help of MDCT with surgically confirmed GI tract perforation cases. The perforation site was correctly diagnosed in 90% of the patients when the radiologists referred to both direct and indirect findings.

Two radiologists analyzed the direct and indirect signs of gastro intestinal perforations and also the site of perforation in these patients. Direct signs are free air and discontinuous bowel wall. Indirect signs are periluminal fat stranding,

fluid collection and focal thickening of bowel wall. Among the signs, free air was found to be seen in 95% of the cases other than appendix and 44% in perforated appendicitis cases. When CECT was done in 44 patients, the presence of discontinuous gastro intestinal wall was directly seen in 14 cases by using axial plane and in 23 cases by using MPR.

Furukawa A et al[25] stated that CT can evaluate even very minute presence of extra luminal air in addition to ascitis, abscess or a foreign body in extra luminal location.

Hainaux B et al[26] observed that CT serves as a beneficial imaging modality of choice for detecting the existence, level and cause of gastro intestinal perforation. An accuracy of 90% has been recorded for detecting the site of perforation in the gastrointestinal tract. In order to arrive at a diagnosis several authors suggest that, the presence of free air as a major finding. CT has been proved to be a highly sensitive imaging modality when compared to plain radiography for the detection of intra, extra, and retroperitoneal free air.

Brofman N et al[27] noticed that CT serves as the most precise tool for detecting trauma related bowel and mesenteric injuries in stable patients. Nearly 5% of the individuals are noticed to have mesenteric and bowel trauma. Definitive diagnosis of blunt abdominal trauma can be made out in CT. Some of them are defect in bowel wall, presence of free air, extravasation of contrast and ischemia of the bowel. Presence of vascular bleeding and abrupt cut-off of mesenteric vasculature is more specific for mesenteric injury. Correlations of clinical

decision with CT features are necessitated when there are inconclusive findings of injury.

Stapakis JC et al[29] demonstrated the CT sensitivity with erect radiograph for the presence of free air in 13 patients who had undergone diagnostic peritoneal lavage (DPL). Initially plain erect radiograph was done within 24 hours of the procedure prior to CT or less than 4 hours after CT abdomen. Presence of free air was detected in only 5 of them by plain radiograph whereas CT detected all 13 patients for free air. All the patients who had undergone CT were divided into three categories and compared with plain erect radiograph. First category patients were those who had less than 3 one millimetre air pockets on CT. Second category patients were those who had more than 3 one millimetre air pockets but less than 13 millimetres on CT. The third category patients were those who had more than 13 millimetres of free air. Two subjects of the first category were totally insensitive in detection of free air by plain radiograph. In the second category only 3 out of 9 subjects showed the presence of free air in plain radiograph and in third category those who had more than 13mm free air on CT were proved to be 100% sensitive on comparing with plain radiograph. This demonstrated that CT to be more beneficial than plain radiograph despite normal abdominal radiography finding.

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Strouse PJ et al[29] conducted a study in the detection of renal calculi its sensitivity and specificity over other modalities. The assessed sensitivity and specificity of unenhanced helical CT was 94.1% and 94.2% against 85.2% and

90.4% for IVU. The unenhanced helical CT took an average in room time of 23 min vs. 1 hour 21 min for IVU

Katz DS et al[30] most renal calculi can be located and measured in plain helical CT because of the radiopacity of renal calculi.

Smith et al[31] surveyed 292 patients with 100 proved ureteral stones, with sensitivity, specificity and accuracy to be 97%, 96% and 97% respectively by using helical CT.

Preminger GM[32] studied that IV pyelography could be eliminated in 90% of cases by using helical CT.

Smith RC et al[33] demonstrated that indications for acute obstruction were oedema and perinephric fat stranding.

Rahul Kumar Reddy G[34] prospective study done over a period of one year. It includes all patients with loin pain, who are clinically suspected for urinary stone disease. It was found that maximum patients belonged to the age group of 41-50 years followed by 31-40 years. Males were more than females. The male to female ratio was 1.8:1. Maximum patients presented with ureteric calculi i.e. 40% followed by renal calculi (18.8%). A total of 23 patients were found to have ureteric calculi. Out of them majority presented with distal ureteric calculi (34.8%) followed by calculi at proximal ureter. Maximum i.e. 66.6% developed hydronephrosis followed by hydroureter in 51.1% of patients. So, he

concluded that Unenhanced MDCT is an excellent modality with many advantages and high sensitivity for evaluation of nephroureterolithiasis.

V. B. Monteiro et al[35] proved that MDCT is a fast and definite examination that help in the identification of calculus in the ureter with shorter scan time, within a single breath hold and with an advantage to eliminate the application of IV contrast because most of the calculi are predominantly radio opaque. He also stated that, multiplanar reconstruction is useful in demonstrating the exact location of stones and their relationship to the ureter, which are characteristically located at the ureteropepelvic junction and the ureterovesical junction.

Tack et al[36] stated that Unenhanced, low-dose, MDCT provides a rapid and accurate diagnosis of ureteral stones, because almost all calculi are radio-opaque at CT.

Sebastia et al[5] stated that thin collimation helps in identification of most of the ureteric calculi. Coronal reformations help in identification such calculi. The differential diagnosis can be excluded by the use contrast enhancing studies.

L. Turturici et al[37] stated that MDCT is helpful when US findings are equivocal or clinical symptoms are nonspecific.

The CT criteria for uncomplicated Acute Cholecystitis:

1. inflamed and thickened gallbladder wall of more than 3 millimeters
2. When the gallbladder is distended, there will be a hyper enhancing mucosal.

3. Reactive inflammatory signs can be visualized in the surrounding hepatic parenchyma.
4. Surrounding fat standings', fluid collection, calculi and thick bile are other features in CT.

In acute abdomen the above mentioned CT features are specific with sensitivity and specificity comparable to those of ultrasound features.

MDCT can also be used to demonstrate complications of acute cholecystitis which may urge a surgical treatment, such as emphysematous and gangrenous cholecystitis, gallbladder perforation and gallstone ileus.

CT is the most sensitive and specific imaging modality for identification of gas in the gallbladder lumen or wall, highly suggestive of emphysematous cholecystitis than USG.

Marco Moschetta et al[38] stated that nearly 1% of cases present with acute ischemic bowel disease in the emergency department. Due to high quality features of MDCT like high temporal and spatial resolution and state of the art post processing techniques the detection of specificity, sensitivity, positive and negative predictive values were 92% to 100%, 64% to 93%, 90% to 100% and 94% to 98% respectively. With this MDCT proved to be the gold standard imaging modality of choice for detection and follow-up of patients with acute bowel ischemia.

A. J. Aschoff et al[39] 2008**,** explored the accuracy of MDCT, using a biphasic mesenteric angiography protocol for evaluation of acute mesenteric ischemia (AMI). In total, 79 consecutive patients with clinical signs of AMI underwent contrast enhanced MDCT. These results were correlated with intraoperative surgical findings, endoscopic results and clinical recovery. Statistical analysis was calculated using the patients in which AMI had been excluded as a control group. Diagnosis of acute mesenteric ischemia was made in 28 patients. 27 out of 28 patients were correctly evaluated for AMI by MDCT with a specificity rate of 97.9%.

The CT findings of AMI are arterial occlusion, pneumatosis intestinalis, gas and thrombosis within the venous channel and bowel wall thickening. The overall sensitivity, specificity and positive and negative predictive values for these findings were 93%, 100% and 100% and 94% respectively. Thus MDCT proved to be a fast and precise tool in diagnosis of questionable patients of AMI.

The CECT findings of ischemic bowel disease are dilated and thickened bowel with abnormal wall enhancement, pneumatosis intestinalis and free fluid in the abdomen.[40] Use of thin collimation and effective post processing techniques viz MPR, 2D MIP and 3D VRT helps in the identification of ischemia.

Rao PM et al[41] prospectively assessed the role of helical CT in the detection of suspicious diverticulitis patients by doing rectal contrast. 150 suspected cases of diverticulitis were subjected to MDCT by giving only colonic contrast. 64 out of 150 were diagnosed to have diverticulitis. All positive patients

were clinically followed up, but 41 patients were correlated with histopathological reports also. In this study when the statistical analysis for CT interpretation of diverticulitis was made the accuracy, sensitivity, specificity and positive and negative predictive values came around 99%, 97%, 100% and 100% and 98% respectively. The remaining 86 out of 150 patients were excluded from diverticulitis.

The CT role in these patients is to confirm the presence of diverticulitis and its related complications like small bowel obstruction, abscess formation, fistula and sinus tract and intraperitoneal perforation. CT plays an excellent tool for detecting other causes of left lower quadrant pain that may mimic diverticulitis.[35]

An accuracy rate of 58% to 100% has been reported for MDCT in the detection of intussusception.[43]

Computed tomography (CT) seems to be the most important and sensitive diagnostic method in confirming a preoperative diagnosis of adult intussusceptions, especially in patients presented with non-specific acute abdominal pain.[45]

In most cases of paediatric population the aetiology for intussusceptions remains idiopathic because it lacks a lead point and most of them are being treated with non operative reduction procedures.

But in nearly 90% of adult population there remains as an underlying aetiology that acts as a lead point. Some of them are benign or malignant conditions, Meckel's diverticulitis and polyps. In some conditions the lead points are diagnosed only intraoperatively. So in order to prevent catastrophic outcome early and prompt evaluation is crucial to avoid the complications like bowel ischemia, peritonitis and perforation.

Onkendi et al[42] evaluated the common findings of intussusceptions in adult population. The most common ones are pain abdomen with 73%, 48% with bowel obstruction, 14% with haem positive stools, 15% with palpable abdominal mass and 2% with complete bowel obstruction.

In addition to identification of intussusceptions, CT also localizes the site of the mass, the nature of the mass, the extent of the mass with adjacent structures and finally in also staging of the malignant aetiologies.

Important CT findings of intussusceptions are bowel obstruction, bowel wall oedema and loss of normal appearance of bowel loops. CT abdomen is also capable of distinguishing intussusceptions without a lead point where there will be no proximal bowel dilatation and from those with a lead point where there will be target or sausage shaped appearance of bowel loops.[44]

For these reasons, we suggest that all patients presenting with a clinical picture of intestinal obstruction should have an abdominal CT scan as a standard diagnostic procedure.

Sebastia C et al[46] demonstrated

1. High specificity and sensitivity of spiral CT makes it screening investigation of choice in aortic dissection.
2. Dedicated spiral CT with rapid contrast infusion with narrow collimation is ideal for 3D imaging.
3. True and false lumen with intervening intimal flap directs towards dissection.

The dissection extending across the branches leads to signs and symptoms of ischemia and infarction of target organs. This mimics clinical features of acute severe abdominal pain.

Differentiation of the true and false lumens is important in treatment planning. Always the false lumen appears greater in size than the true lumen. The other important findings of false lumen are the presence of thrombus. The junction of the flap with the outer wall of the false lumen produces an acute angle, called the "beak sign". Thrombosis of the false lumen may mimic an aneurysm with mural thrombus. Associated findings include ischemia or infarctions of organs supplied by branch arteries.

The three most common clinical findings of aortic aneurysm rupture are palpable pulsatile mass, pain abdomen and hypotension. These findings are most commonly seen elderly men who smoke. About 1/3 of cases do not present with classical findings of aneurysm rupture. In such cases they are mistreated as

diverticulitis or renal colicky. Other related CT findings are hematoma in retro peritoneum and extravasation of IV contrast.

MDCT is the primary imaging modality used for serial imaging in patients with aortic aneurysm. For accurate aneurysm analysis the use of 2D multiplanar reconstruction techniques help in the interpretation and display of measurements. It has been shown that aneurysm measurement with 3D reconstructions resulted in significantly lower inter-observer variability compared with axial sections alone.[47]

In the assessment of aortic aneurysm angiographic study of CT has virtually replaced conventional angiographic study by the use of spiral CT and effective post processing techniques. For excellent contrast opacification of the vessels fast IV contrast application at a rate exceeding 3 mL/sec.

Thin 3 mm sections with 3D images and without oral contrast interference helps in better visualisation of the reconstructed images. The dimensions of aneurysm, presence of mural thrombi and its relationship with major branches of aorta are readily acquired by spiral CT and helps in identification of the site of bleeding.[48]

Major complication of abdominal aortic aneurysm is its rupture, accounting for approximately 5% of survival rate. More than one third of the patients could not be able to reach the medical facility. Some reach the emergency with intense abdominal pain with absent peripheral pulses in the lower limb leads to diagnosis of aortic aneurysm.

OBSERVATION AND RESULTS

In this study 73 patients were evaluated with MDCT, the findings of MDCT were compared with the surgical intraoperative findings, histopathological findings, recovery for conservatively managed patients.

I. AGE

Table no 1 showing the age distribution in the study population.

AGE GROUPS (Years)	FREQUENCY	PERCENTAGE %
0 to 10	4	5
11 to 20	6	8
21 to 30	8	11
31 to 40	16	22
41 to 50	12	16
51 to 60	9	12
61 to 70	11	15
71 to 80	6	8
91 to 100	1	1
TOTAL	**73**	**100**

FIGURE 1: FREQUENCY DISTRIBUTION IN AGE GROUPS

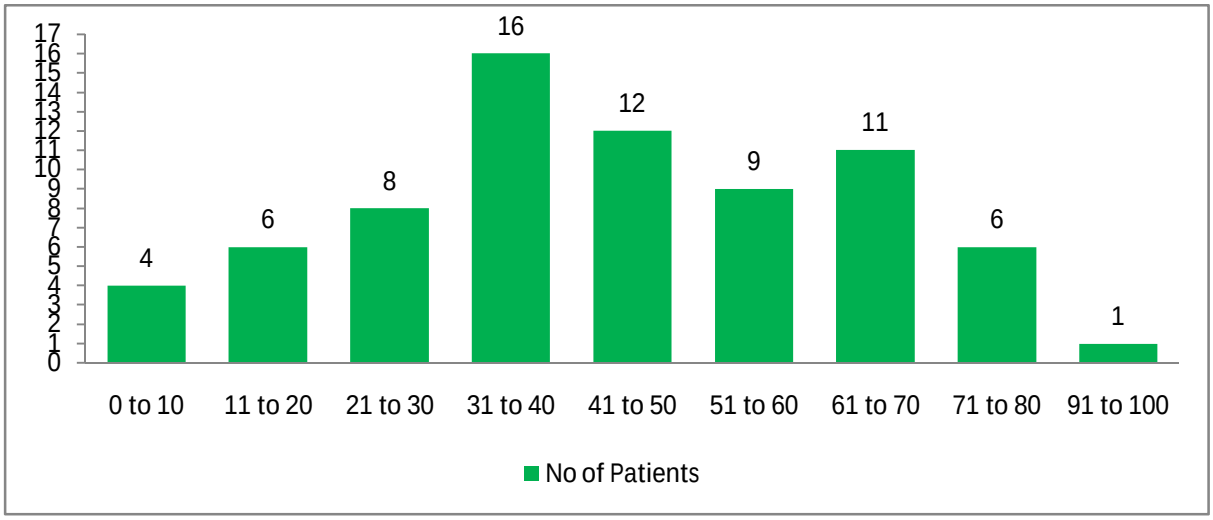
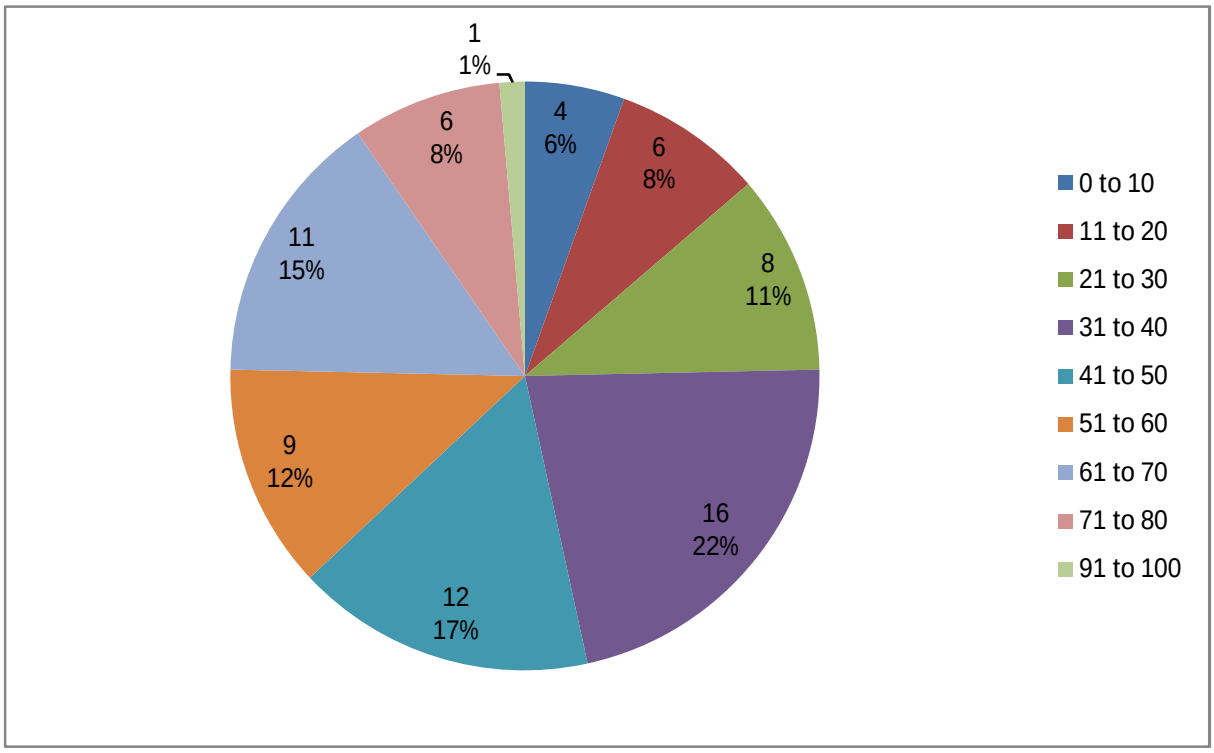


Figure no 1 is a bar chart showing age in groups and the number of patients in the study population. 73 patients (53 men and 20 women; mean age, 44 to 45 Years).

FIGURE 2: PERCENTAGE DISTRIBUTION IN AGE GROUPS (Years)



The above pie chart shows the percentage of the study population according to age groups.

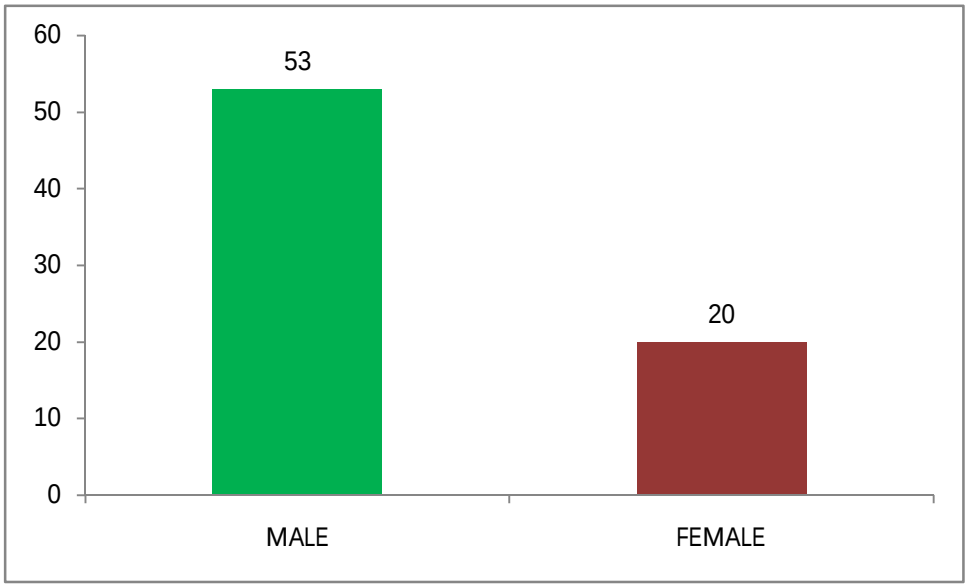
II. SEX DISTRIBUTION

Table no 2 showing the gender distribution in the study population.

SEX	FREQUENCY	PERCENTAGE %
MALE	53	73
FEMALE	20	27
TOTAL	**73**	**100**

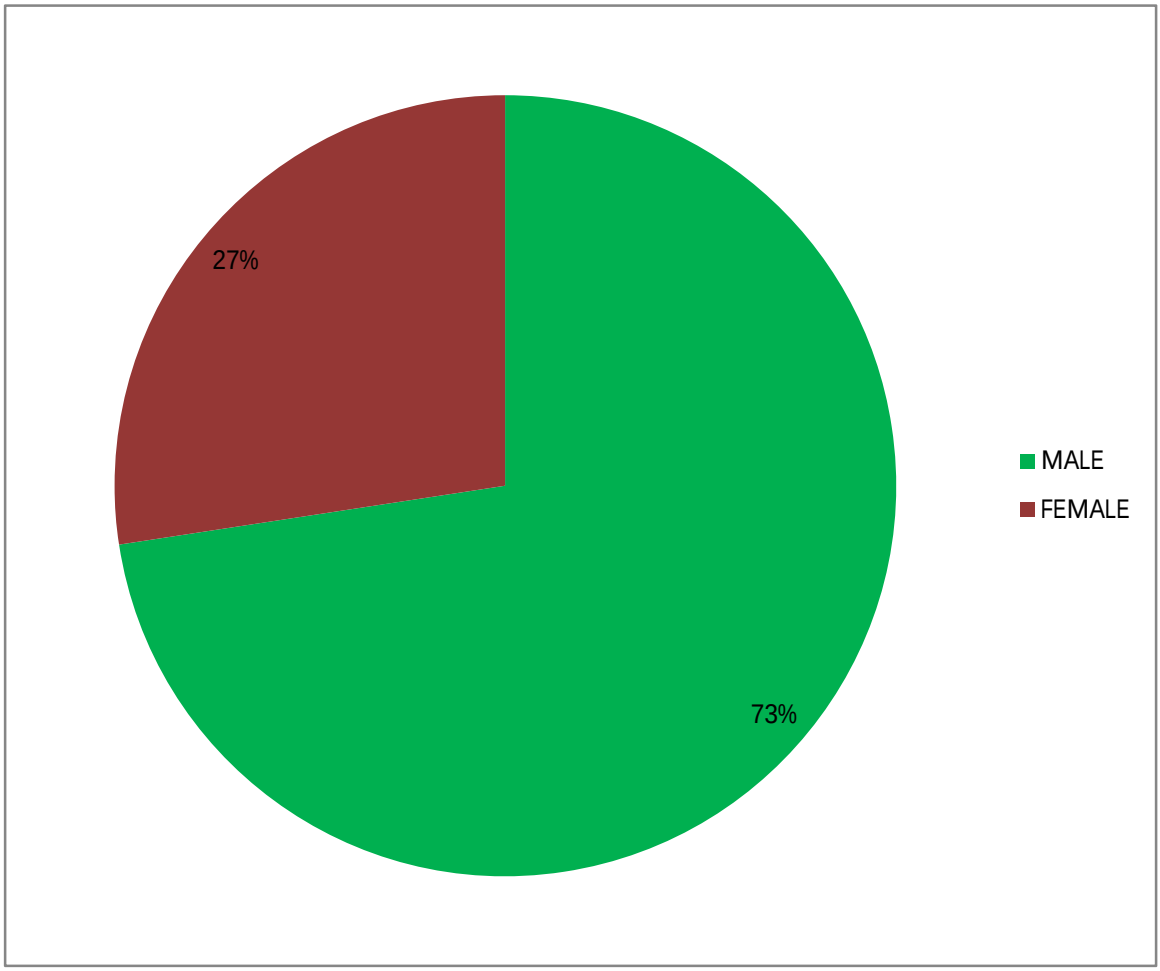
The above table shows that 73% of the study population were Males, and 27% were females.

FIGURE 3: GENDER AND FREQUENCY



The above bar chart shows the number of persons according to gender.

FIGURE 4: GENDER AND PERCENTAGE



The above pie chart shows the percentage of the study population, with 73% being males and 27% being females.

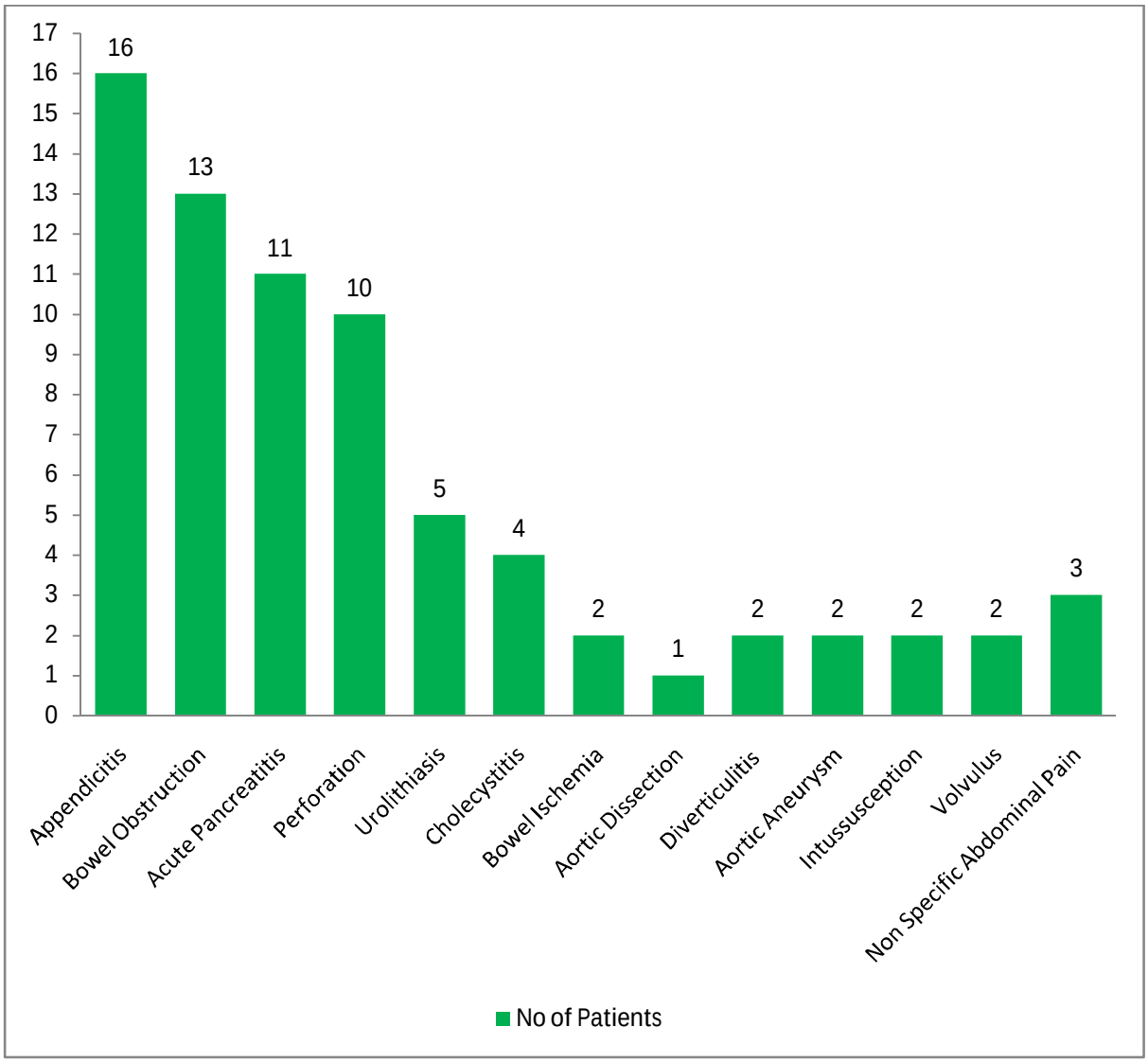
III. PATHOLOGY DETECTED IN STUDY POPULATION

Table no 3: Various pathologies detected are tabulated.

NO	PATHOLOGY	FREQUENCY	PERCENTAGE %
1	Appendicitis	16	22
2	Bowel Obstruction	13	18
3	Acute Pancreatitis	11	15
4	Perforation	10	14
5	Urolithiasis	5	7
6	Cholecystitis	4	5
7	Bowel Ischemia	2	3
8	Aortic Dissection	1	1
9	Diverticulitis	2	3
10	Aortic Aneurysm	2	3
11	Intussusception	2	3
12	Volvulus	2	3
13	Non Specific Abdominal Pain	3	4
	TOTAL	**73**	**100**

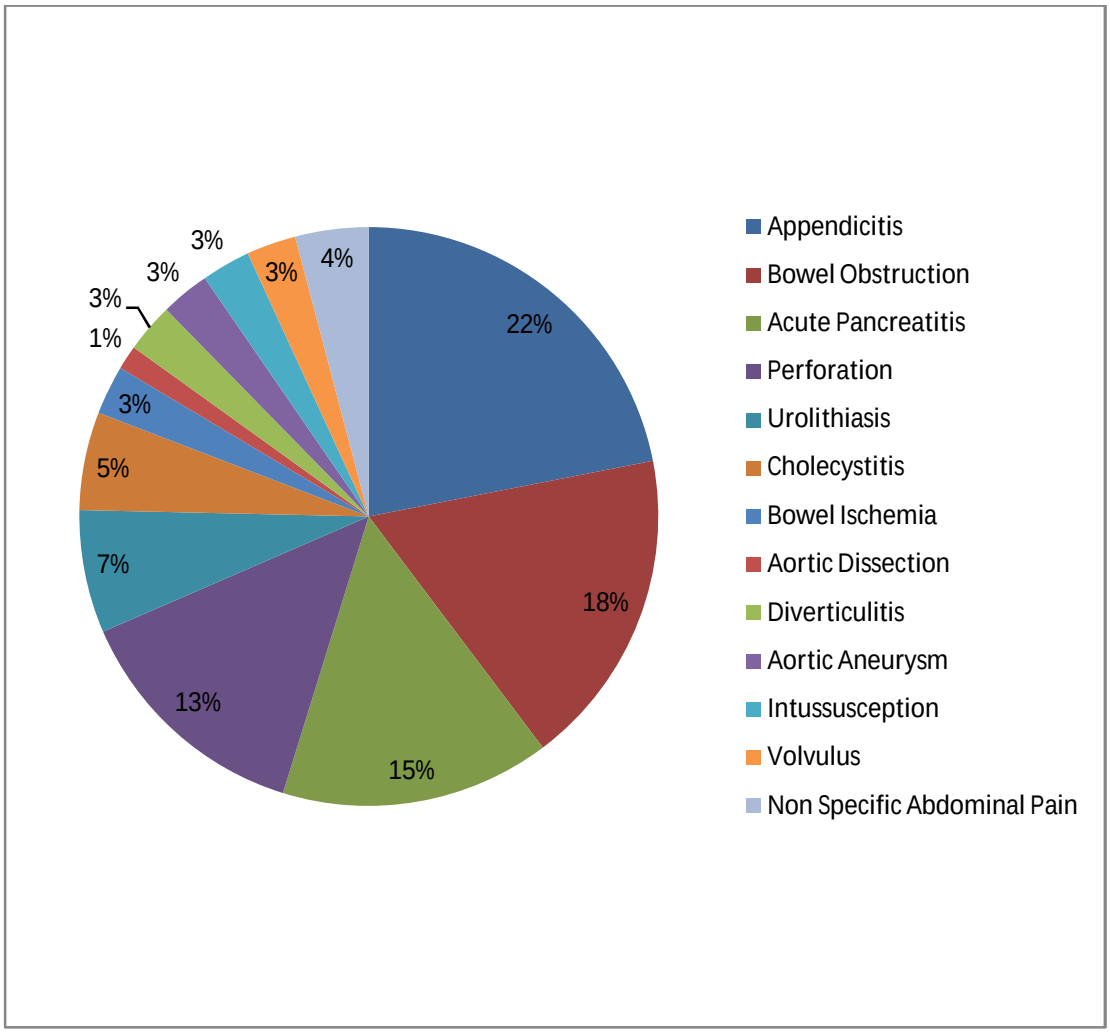
The above table shows the frequency and percentage of the various pathologies detected among the study population.

FIGURE 5: FREQUENCY AND PATHOLOGY DETECTED



The above bar chart shows the number of patients in which pathologies were detected in the study population.

FIGURE 6: PERCENTAGE OF THE PATHOLOGY DETECTED



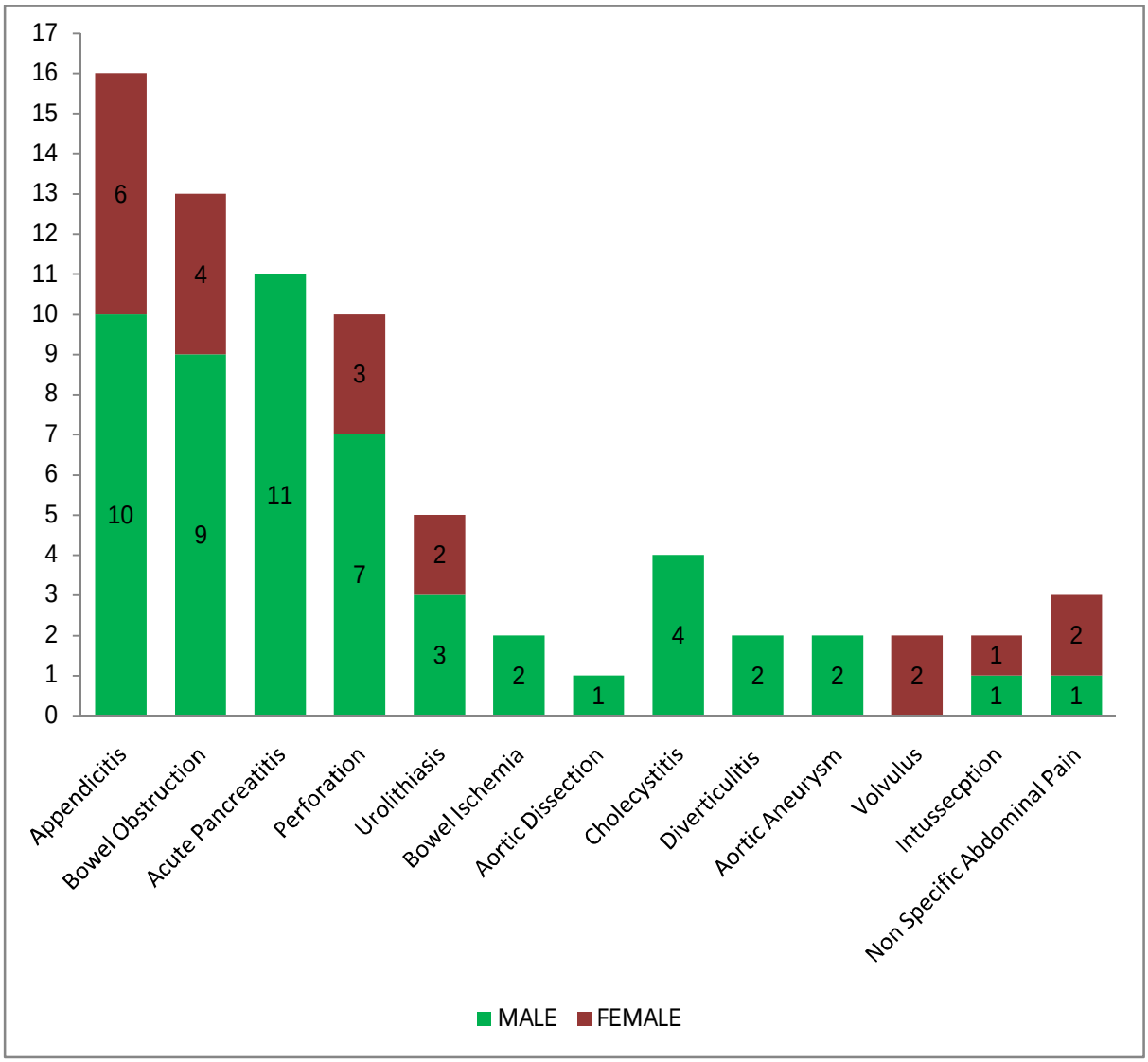
The above pie chart shows the percentage of patients of various pathologies, detected in the study population.

IV: GENDER WISE PATHOLOGY DETECTED

Table no 4: Various pathologies detected gender wise is tabulated.

NO	PATHOLOGY	FREQUENCY	MALE	FEMALE
1	Appendicitis	16	10	6
2	Bowel Obstruction	13	9	4
3	Acute Pancreatitis	11	11	
4	Perforation	10	7	3
5	Urolithiasis	5	3	2
6	Bowel Ischemia	2	2	
7	Aortic Dissection	1	1	
8	Cholecystitis	4	4	
9	Diverticulitis	2	2	
10	Aortic Aneurysm	2	2	
11	Volvulus	2		2
12	Intussecption	2	1	1
13	Non Specific Abdominal Pain	3	1	2
	TOTAL	**73**	**53**	**20**

FIGURE 7: GENDER AND PATHOLOGY DETECTED



The above bar chart shows the number of patients' gender wise in which pathologies were detected in the study population.

V. STATISTICAL ANALYSIS

Table no 5: The Sensitivity / Specificity statistical results are computed below.

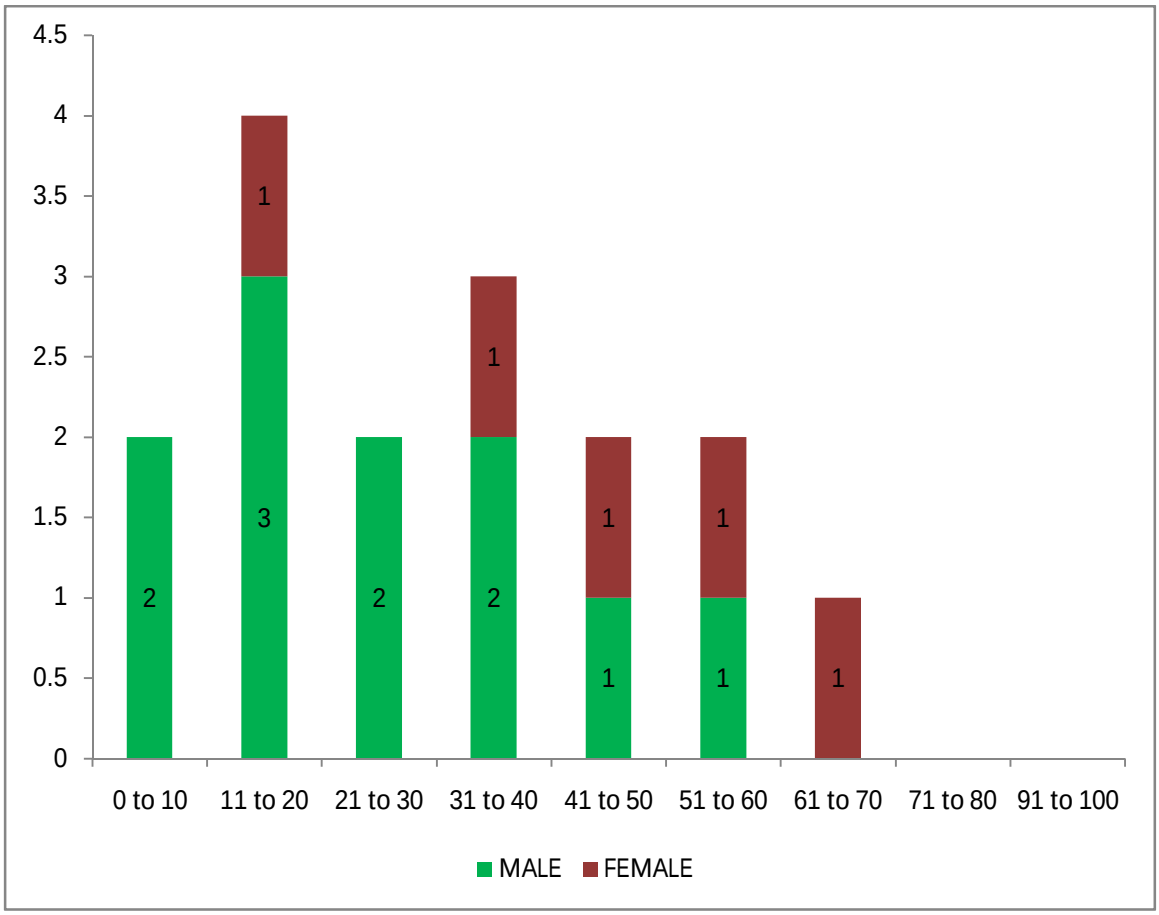
Statistic	**MDCT IN ACUTE ABDOMEN CASES**
Sensitivity	97.10%
Specificity	75.00%
Positive Predicitive Value	98.53%
Negative Predicitive Value	60.00 %

VI. APPENDICITIS

Table no 6: Age groups wise distribution of appendicitis tabulated below.

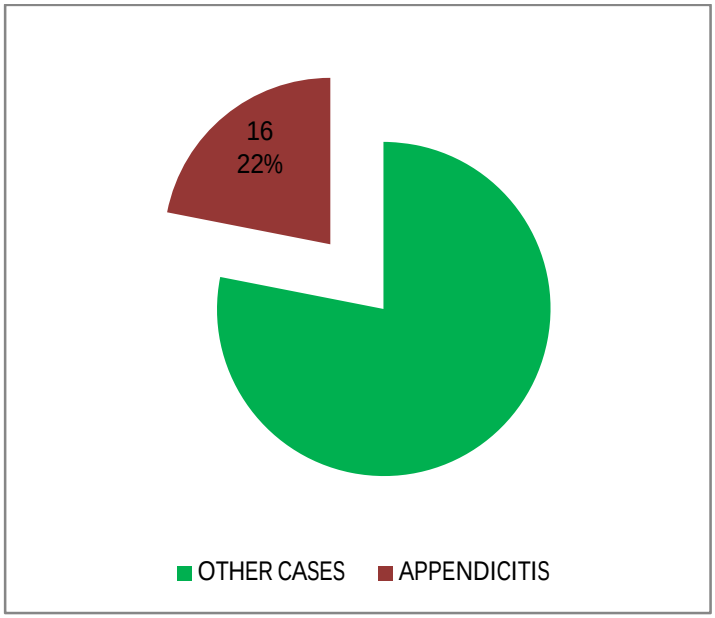
AGE GROUPS (Years)	MALE	FEMALE
0 to 10	2	
11 to 20	3	1
21 to 30	2	
31 to 40	2	1
41 to 50	1	1
51 to 60	1	1
61 to 70		1
71 to 80		
91 to 100		
TOTAL (16)	**11**	**5**

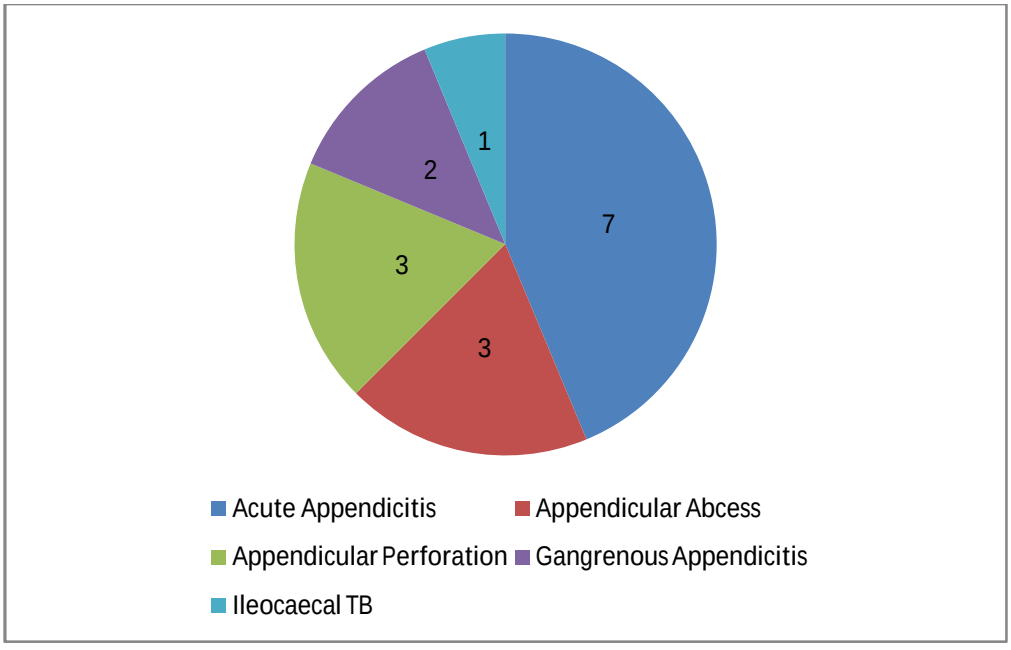
FIGURE 8: GENDER AND AGE GROUPS DISTRIBUTION - APPENDICITIS



The above bar chart shows the number of patients in age groups wise in which appendicitis were detected in the study population.

FIGURE 9: PERCENTAGE & FREQUENCY DISTRIBUTION OF ACUTE APPENDICITIS AND RELATED PATHOLOGIES





9a. Among the 73 cases, 22% of appendicitis and its related pathologies were identified.

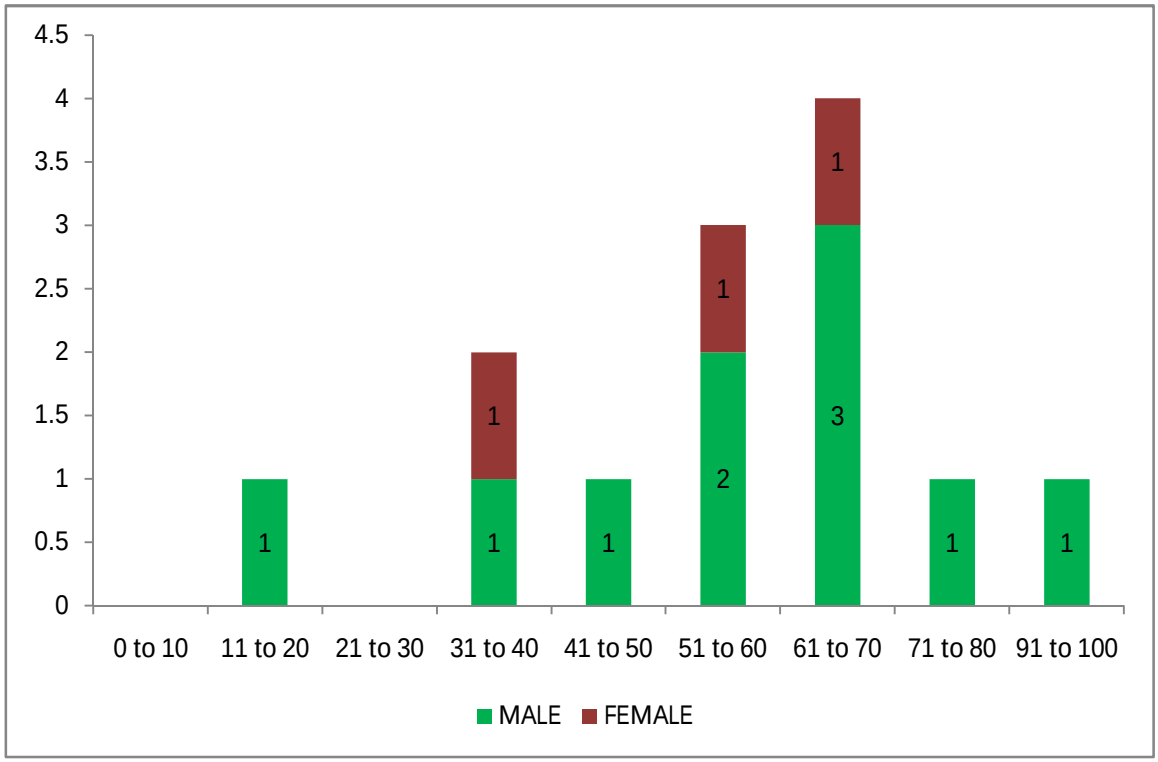
9b. The pie chart demonstrates the efficacy of MDCT in detection of acute appendicitis and its related conditions.

VII. BOWEL OBSTRUCTION

Table no 7: Age groups wise distribution of bowel obstruction tabulated below.

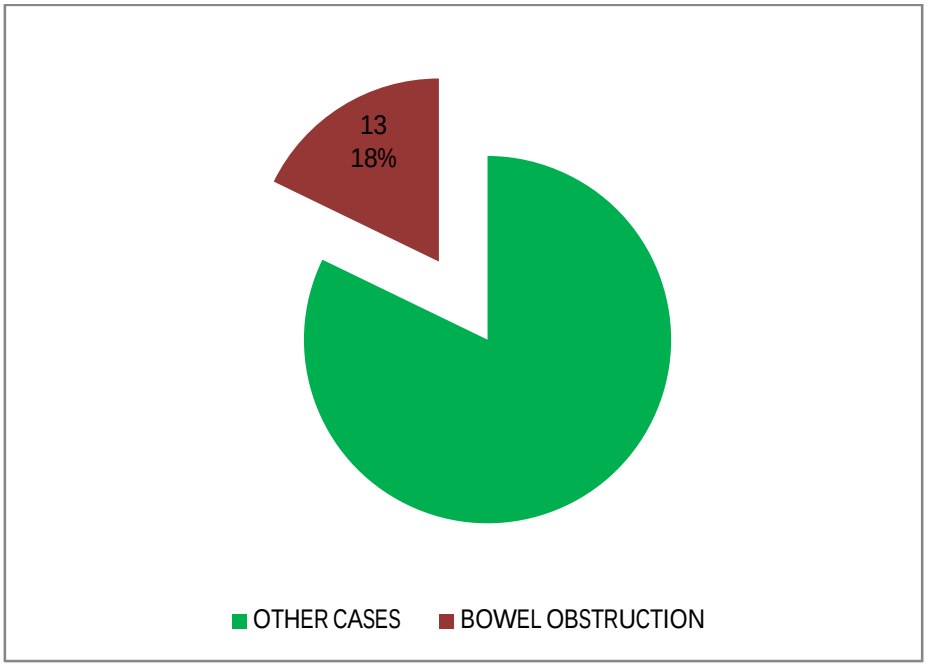
AGE GROUPS (Years)	MALE	FEMALE
0 to 10		
11 to 20	1	
21 to 30		
31 to 40	1	1
41 to 50	1	
51 to 60	2	1
61 to 70	3	1
71 to 80	1	
91 to 100	1	
TOTAL (13)	**10**	**3**

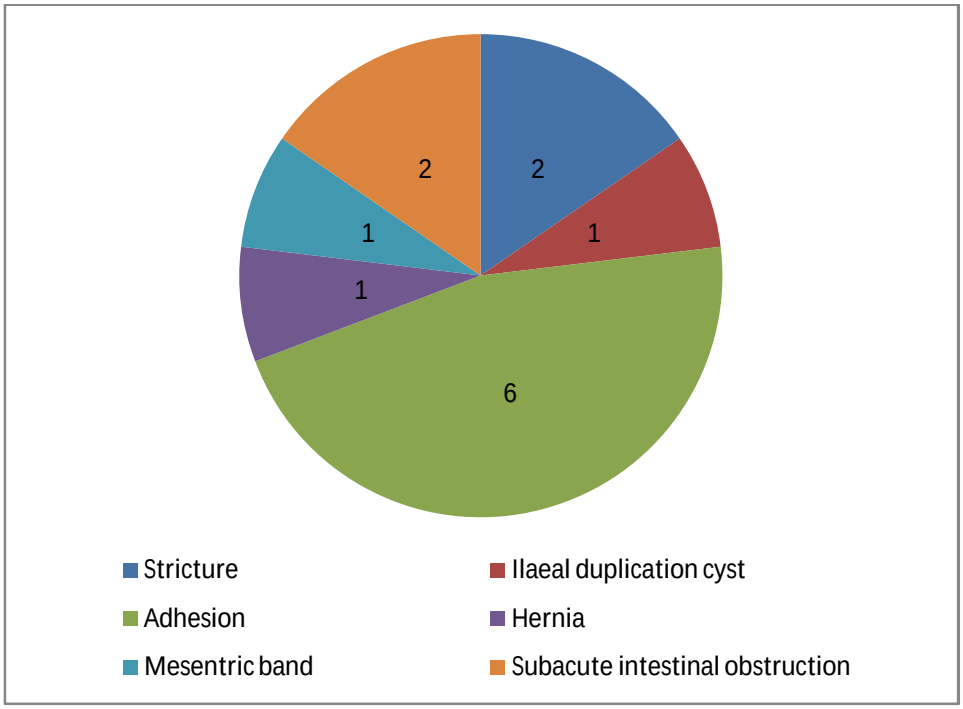
FIGURE 10: GENDER AND AGE GROUPS DISTRIBUTION - BOWEL OBSTRUCTION



ddThe above bar chart shows the number of patients in age groups wise in which bowel obstruction were detected in the study population.

FIGURE 11: PERCENTAGE & FREQUENCY DISTRIBUTION - BOWEL OBSTRUCTION





11a. Among the 73 cases, 18% of bowel obstruction and its related pathologies were identified.

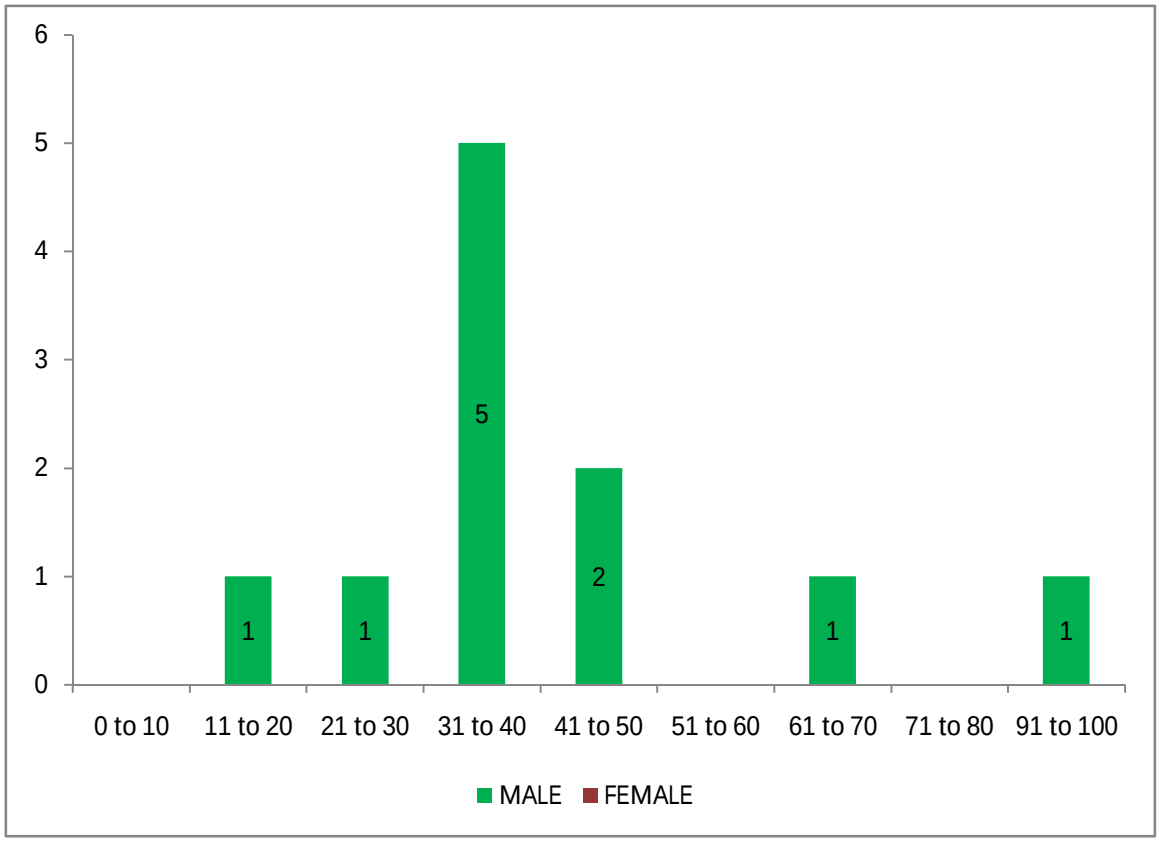
11b. The pie chart demonstrates the efficacy of MDCT in detection of various etiologies of bowel obstruction.

VIII. ACUTE PANCREATITIS

Table no 8: Age groups wise distribution of acute pancreatitis tabulated below.

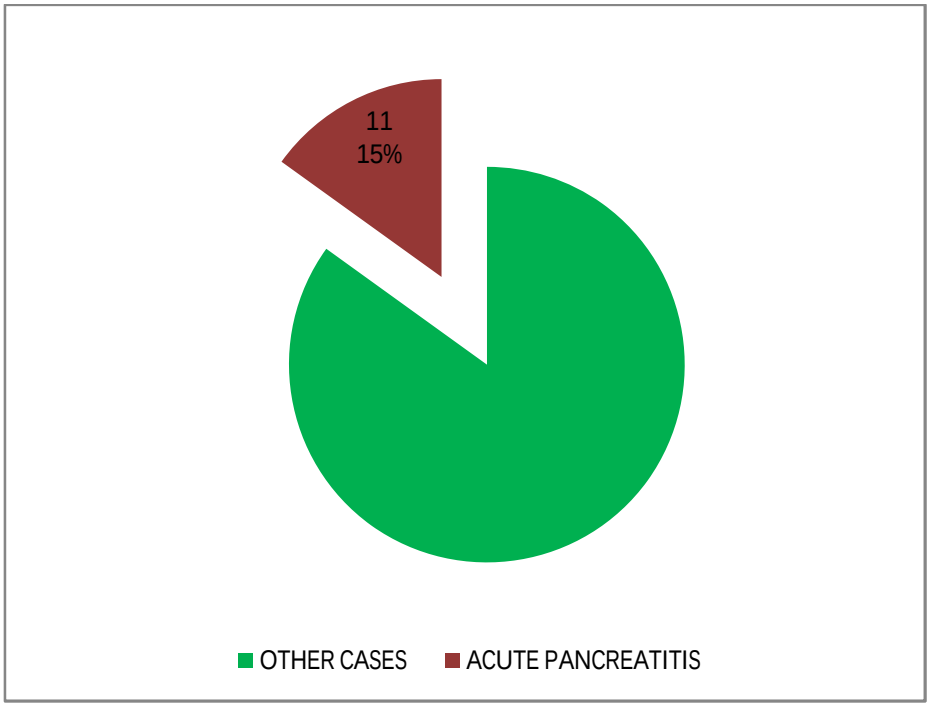
AGE GROUPS (Years)	MALE	FEMALE
0 to 10		
11 to 20	1	
21 to 30	1	
31 to 40	5	
41 to 50	2	
51 to 60		
61 to 70	1	
71 to 80		
91 to 100	1	
TOTAL (11)	**11**	

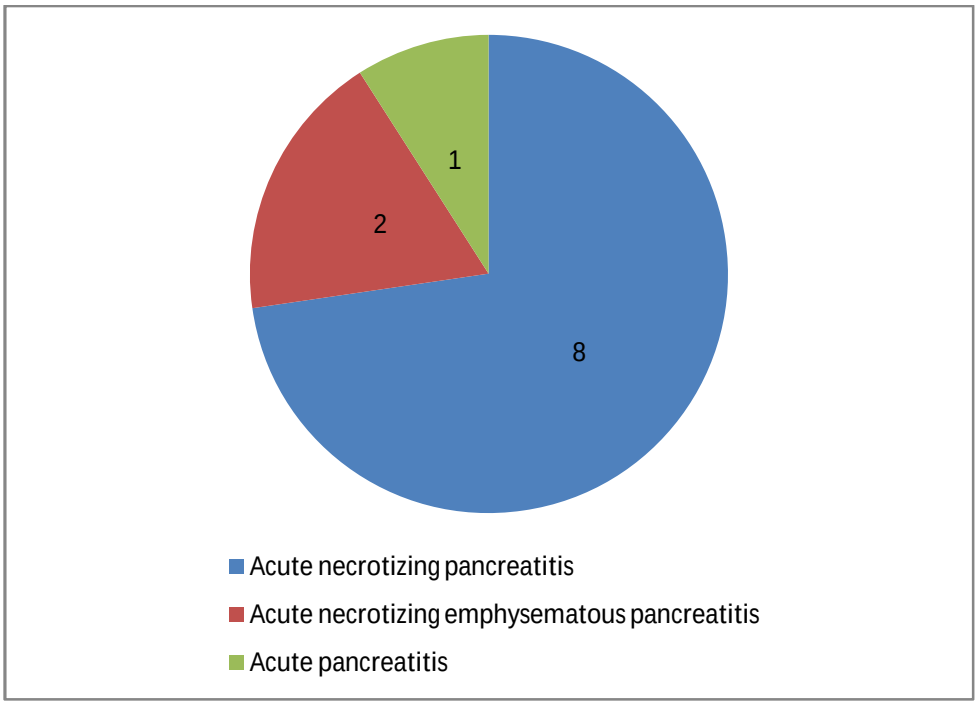
FIGURE 12: GENDER AND AGE GROUPS (Years) DISTRIBUTION



The above bar chart shows the number of patients' age groups wise in which acute pancreatitis were detected in the study population.

FIGURE 13: PERCENTAGE & FREQUENCY DISTRIBUTION - ACUTE PANCREATITIS





13a. Among the 73 cases, 15% of acute pancreatitis and its related pathologies were identified.

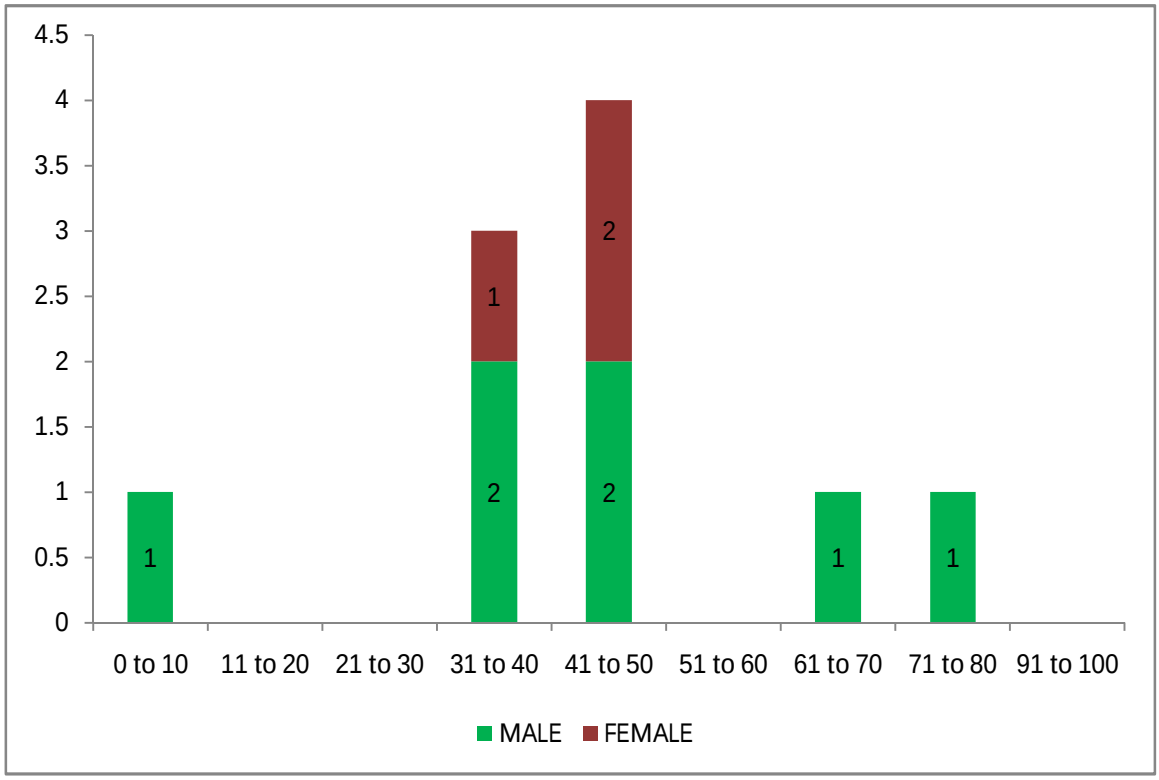
13b. The pie chart demonstrates the efficacy of MDCT in detection of acute pancreatitis cases and its related conditions.

IX. PERFORATION

Table no 9: Age groups wise distribution of perforation tabulated below.

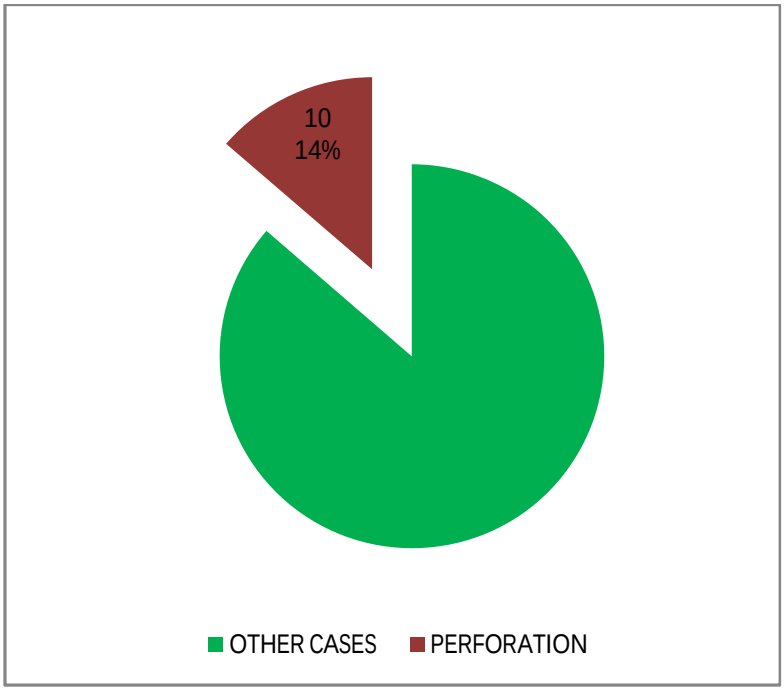
AGE GROUPS (Years)	MALE	FEMALE
0 to 10	1	
11 to 20		
21 to 30		
31 to 40	2	1
41 to 50	2	2
51 to 60		
61 to 70	1	
71 to 80	1	
91 to 100		
TOTAL (10)	**7**	**3**

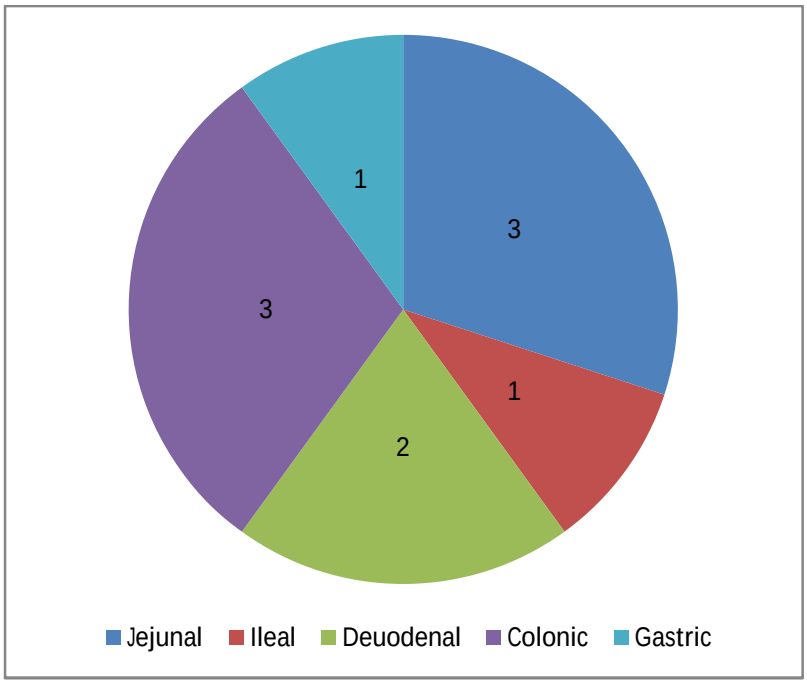
FIGURE 14: GENDER AND AGE GROUPS (Years) DISTRIBUTION



The above bar chart shows the number of patients in age groups wise in which perforation were detected in the study population.

FIGURE 15: PERCENTAGE & FREQUENCY DISTRIBUTION – PERFORATION





15a. Among the 73 cases, 14% of perforation and its related pathologies were identified.

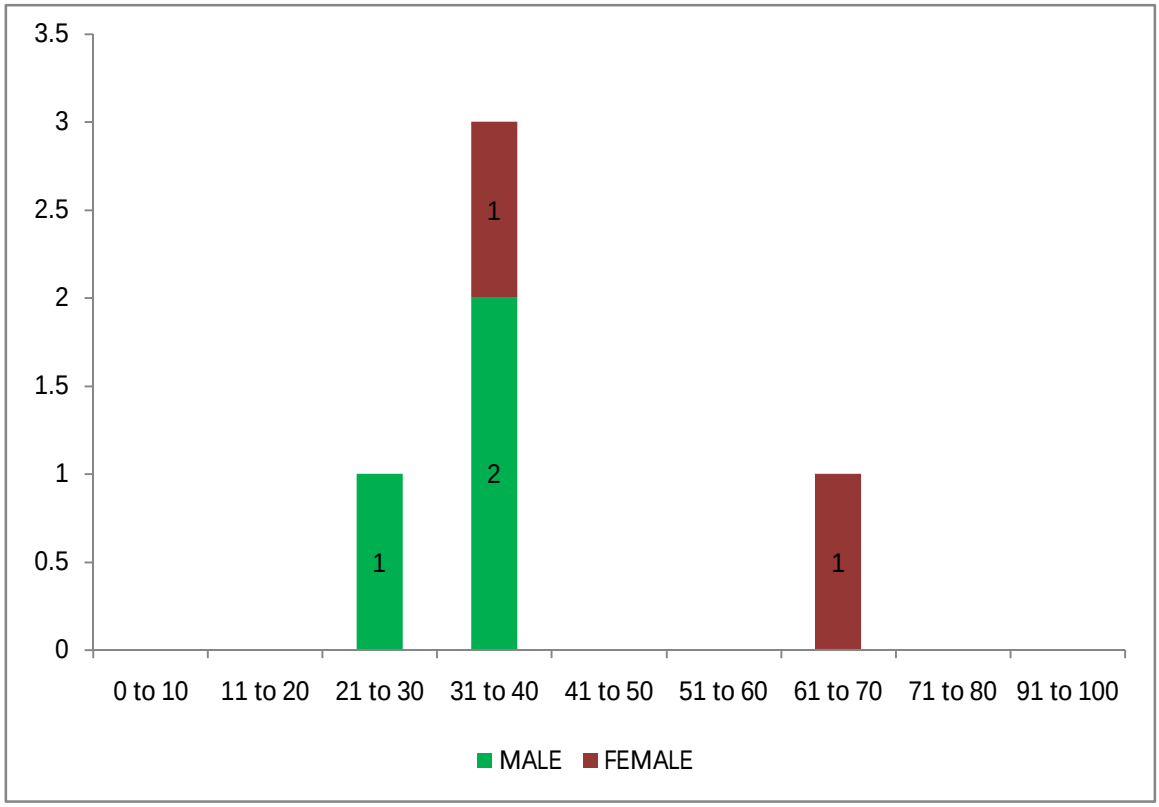
15b. The pie chart demonstrates the efficacy of MDCT in detection of perforation.

X. UROLITHIASIS

Table no 10: Age groups wise distribution of urolithiasis tabulated below.

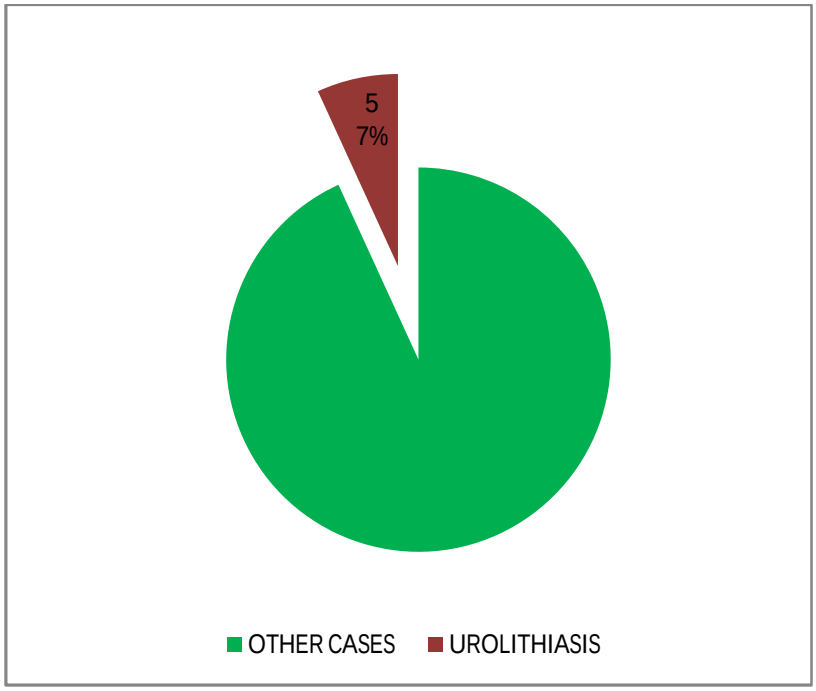
AGE GROUPS (Years)	MALE	FEMALE
0 to 10		
11 to 20		
21 to 30	1	
31 to 40	2	1
41 to 50		
51 to 60		
61 to 70		1
71 to 80		
91 to 100		
TOTAL (5)	**3**	**2**

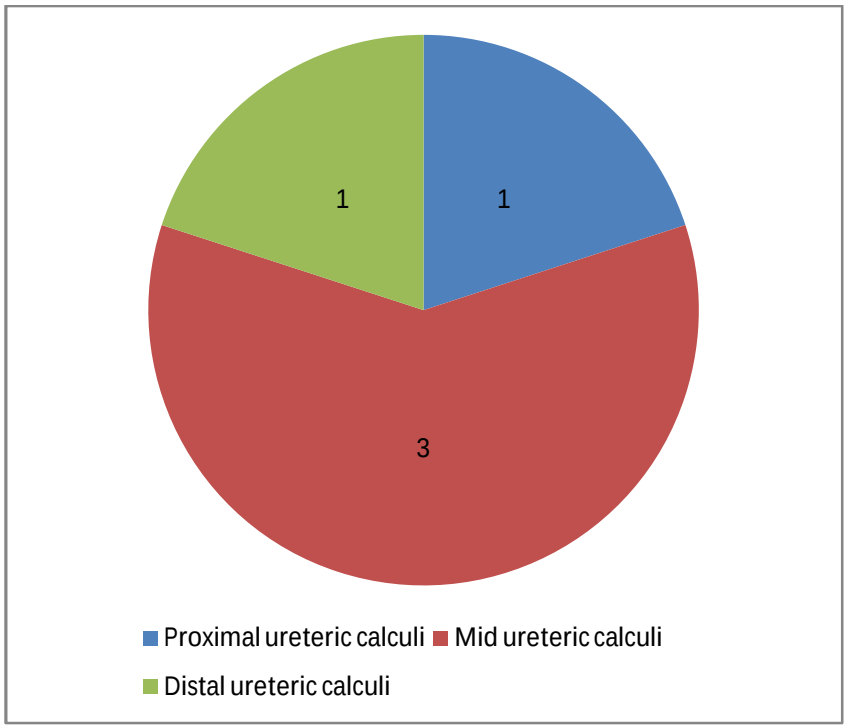
FIGURE 16: GENDER AND AGE GROUPS DISTRIBUTION



The above bar chart shows the number of patients in age groups wise in which urolithiasis were detected in the study population.

FIGURE 17: PERCENTAGE & FREQUENCY DISTRIBUTION - UROLITHIASIS





17a. Among the 73 cases, 7% of urolithiasis and its related pathologies were identified.

17b. The pie chart demonstrates the efficacy of MDCT in detection of calculi.

XI. CHOLECYSTITIS

Table no 11: Age groups wise distribution of cholecystitis tabulated below.

AGE GROUPS (Years)	MALE	FEMALE
0 to 10		
11 to 20		
21 to 30		
31 to 40		
41 to 50		
51 to 60	2	
61 to 70		
71 to 80	2	
91 to 100		
TOTAL (4)	**4**	

FIGURE 18: GENDER AND AGE GROUPS (Years) DISTRIBUTION

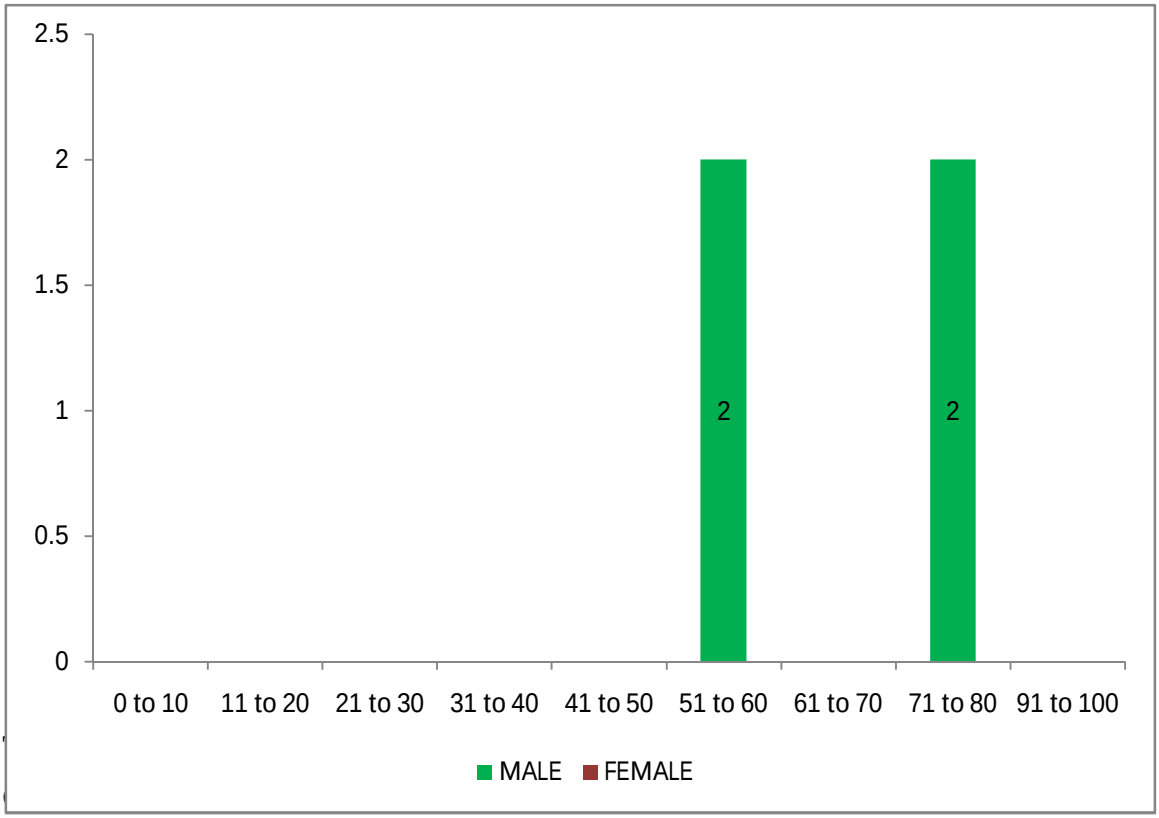
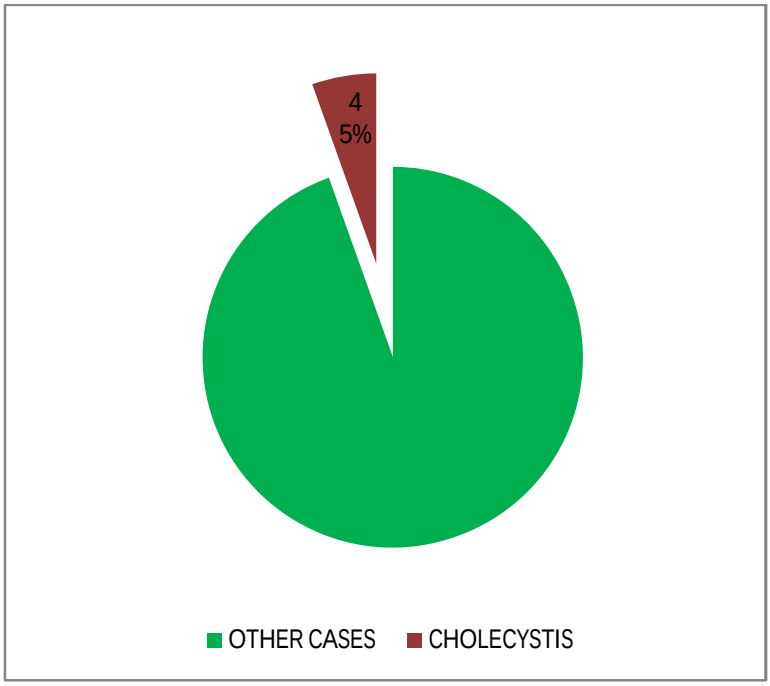
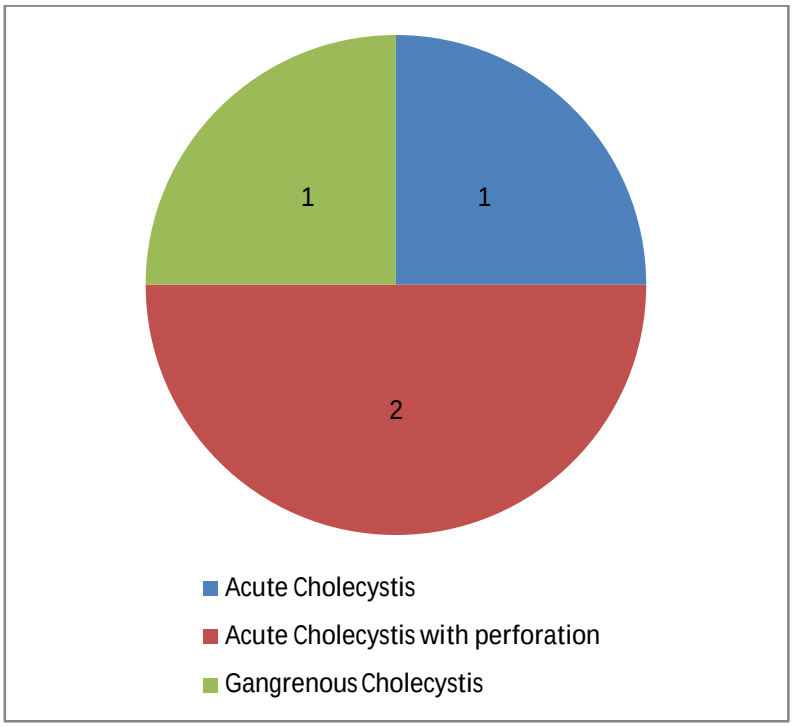


FIGURE 19: PERCENTAGE & FREQUENCY DISTRIBUTION - CHOLECYSTITIS





19a. Among the 73 cases, 5% of cholecystitis and its related pathologies were identified.

19b. The pie chart demonstrates the efficacy of MDCT in detection of acute cholecystitis.

XII. SUMMARY OF STATISTICAL ANALYSIS

Table no 12: Summary of Diagnostic efficacy for various pathologies.

Statistic	MDCT IN ACUTE ABDOMEN CASES
Sensitivity	97.10%
Specificity	75.00%
Positive Predicitive Value	98.53%
Negative Predicitive Value	60.00 %

TABLE 13: SUMMARY OF CONCORDANCE AND ACCURACY

	NO OF CASES CONCORDANT WITH FINAL DIAGNOSIS
NO OF PATIENTS	70
PERCENTAGE %	95.89%

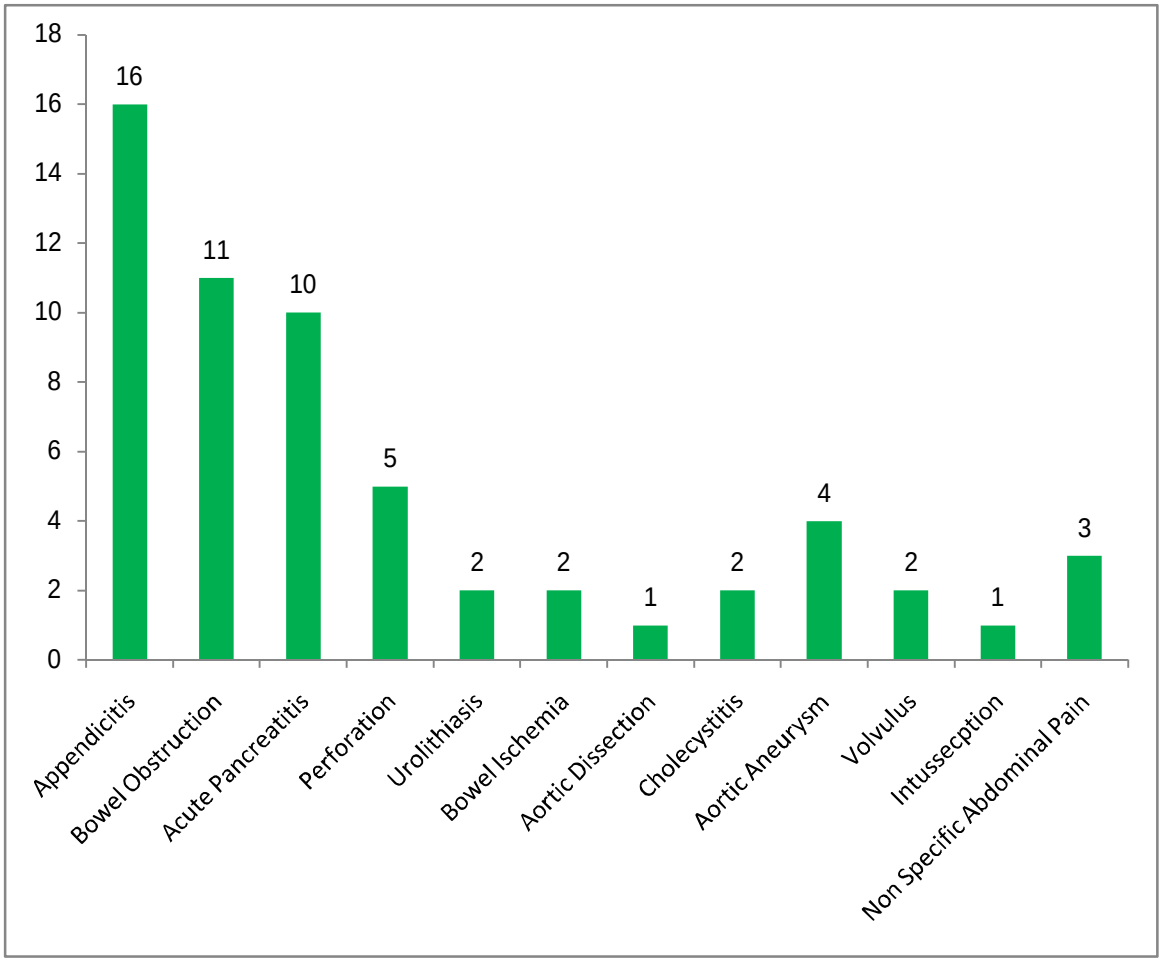
The overall accuracy rate in our study population was 95.89%.

XIII. DISTRIBUTION OF DIFFERNENT TYPES OF SURGICAL MANAGEMENTS

Table no 13: Distribution of different types of surgical management.

SURGICAL MANAGEMENT	FREQUENCY
Appendicitis	16
Bowel Obstruction	11
Perforation	10
Urolithiasis	5
Bowel Ischemia	2
Volvulus	2
Aortic Dissection	1
Intussusception	2
Cholecystitis	4
Acute Pancreatitis	2
Aortic Aneurysm	1
Non Specific Abdominal Pain	3
Total	**59**

FIGURE 20: SURGICAL MANAGEMENT DISTRIBUTION

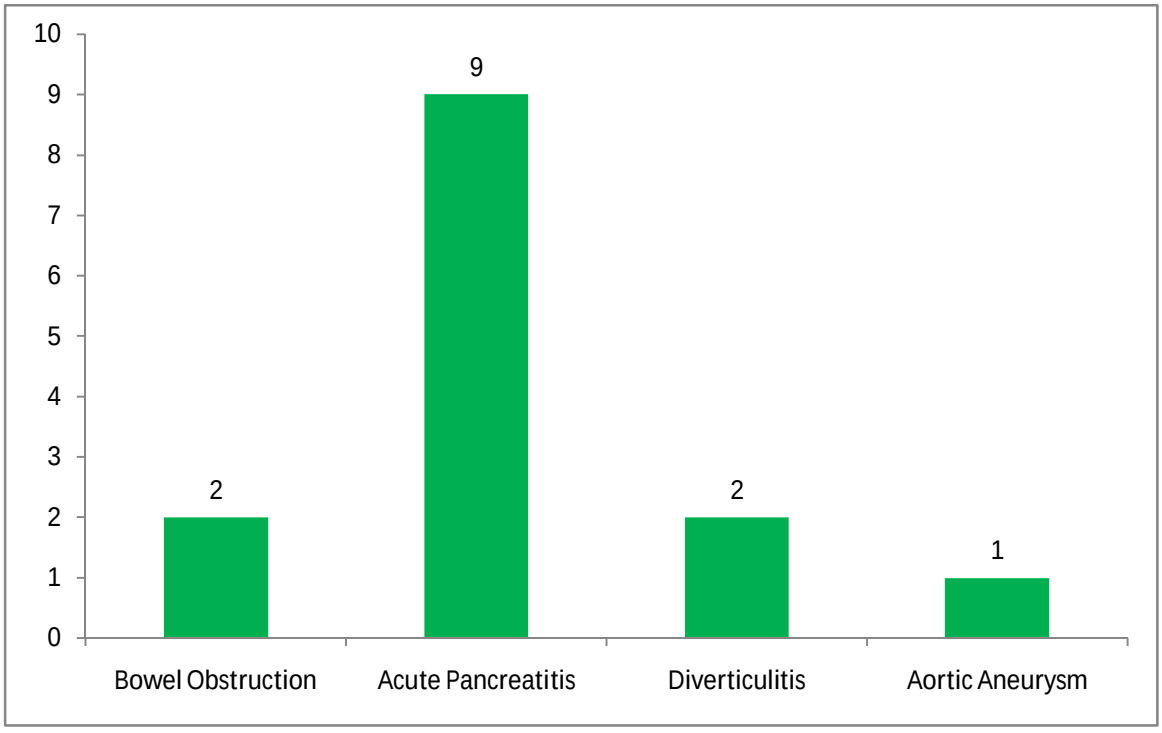


XIV. DISTRIBUTION OF DIFFERNENT TYPES OF CONSERVATIVE MANAGEMENTS

Table no 14: Distribution of different types of conservative management.

CONSERVATIVE MANAGEMENT	FREQUENCY
Bowel Obstruction	2
Acute Pancreatitis	9
Diverticulitis	2
Aortic Aneurysm	1
Total	**14**

FIGURE 21: CONSERVATIVE MANAGEMENT DISTRIBUTION

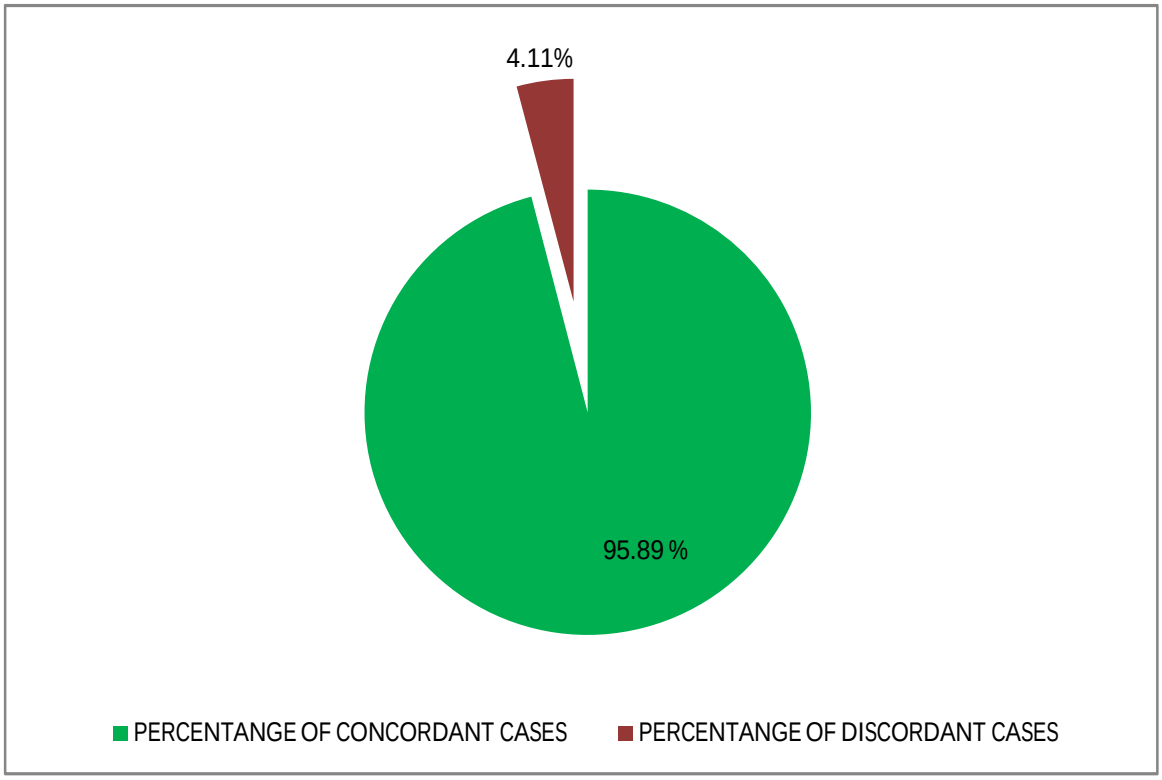


XV. CT FINDING Vs. SURGICAL / HISTOPATHOLOGICAL / CLINICAL RECOVERY

Table no 15: Correlation CT finding.

TOTAL NO OF CASES WITH CONCORDANCE	TOTAL NO OF CASES WITH DISCORDANCE
70	3

Figure no. 22: Percentage of concordant and discordant cases



The above pie chart demonstartes the percentage of concordant and discordant cases of MDCT study population.

DISCUSSION

The aim of our study was to assess the role of MDCT (128 slice scanner) in the evaluation of various pathologies of acute abdomen. The final diagnosis of acute abdomen are correlated with surgical and with available histopathological findings. In non-surgical conditions, those patients who are conservatively managed are followed up till clinical recovery and correlated with MDCT findings. The sensitivity, specificity, and positive and negative predictive values are compared in various pathologies with surgical, histopathological findings, clinical recovery.

The cutting edge new MDCT over the years from single detector CT has clinical advancement in the management of acute abdomen cases.

1. The reduced scanning time leads to improved output and reduces artefacts by improved acquisition in fraction of second is critical in evaluation of sick patients.
2. The large volumetric data obtained in the axial plane allows reformations into required plane even in micrometre pathologies.
3. Dedicated contrast injection techniques and image reconstruction precisely localizes blood vessel pathologies.
4. The advanced reformation techniques save time in critically ill patients by increasing the computing speed and facilitating faster radiological interpretation.

Theoretically MDCT offers many advantages it still has few drawbacks like, cone artefacts, which form when the x rays oscillate like a top in the

circumferential motion. However the application of MDCT has not reduced due to cone beam artefact.

Second shortcoming is because of the usage of large sets of images for CT abdomen in the workstation which makes the image analysis difficult through films.

For several years MDCT has played an important role in the diagnosis of acute abdomen cases. The role of MDCT has significantly lessened the use of plain radiography because of its rapid execution, broader view of interpretation and its effectiveness of providing the differential diagnosis in inconclusive cases.

Our experience confirms the results reported in literature for all acute abdomen pathology. The CT findings were evaluated by complete agreement between CT findings & final discharge diagnosis. The CT finding was totally discordant with intraoperative findings in the following cases: Sealed perforation and under estimating appendiceal inflammation.

In our study group of 73 patients 53 males and 20 females, ranging from 5 to 93 years. We evaluated the various causes of acute abdomen. Common findings were acute appendicitis – 22%, bowel obstruction - 18%, acute pancreatitis – 15%, bowel perforation - 14%. Among which appendicitis is the most common cause and is consistent with most of the studies carried out internationally.

In our study the accuracy rate, sensitivity, specificity and positive and negative predictable values of MDCT were 95.89%, 97.10%, 75% and 98.53%

and 60% respectively which was comparable to the study results of **Monica Mangini et al.**[7]

In our study 16 patients had CT findings of acute appendicitis and related conditions. One out of 16 was disconcordant with intraoperative surgical findings and was diagnosed to be ileoceacal tuberculosis and confirmed by histopathological examinations. The findings of MDCT in this case were obscured by entangled bowel loops in the right iliac fossa.

The sensitivity and Positive Predictable Value were 100% and 93.75% respectively. Intra abdominal findings very well correlated with CT findings except for one case. This is consistent with study conducted by **Rao PM et al**[8] which shows 91% to 100% sensitivity for CT in the diagnosis of appendicitis.

In our study 13 out of 73 cases were diagnosed to have bowel obstruction. The various etiologies of bowel obstruction are stricture, adhesion, hernia and mesenteric band. The sensitivity and positive predictable value were 100%.

Our results were also comparable with **Mallo et al**[16] in which sensitivity of MDCT in diagnosis of bowel obstruction is 81% to 100% and specificity 68% to 100%.

A study conducted by **Suri S et al**[12] shows that CT is highly sensitive in determining level and cause of obstruction.

About 11 out of 73 cases of our study had CT findings confirming acute pancreatitis with sensitivity of 100%. Comparable results are shown by **Beger HG**

et al[19] The sensitivity was 100% for CT in estimating the severe necrotic cases. But the sensitivity reduces to half the level when the necrosis is limited.

It was mostly in males in 4th decade and most of the underlying etiologies were due to alcohol abuse. Similar observations were made by **Balthazar EJ et al.**[18&20]

Acute pancreatics and CT findings very well correlate with severity. It accurately detects the complications like pseudo aneurysm of splenic artery and porto mesenteric venous occlusion. Curved planar reformations are useful in displaying the whole tortuous pancreas, tracing the cholangiopancreatic duct and peri-pancreatic vessels and highlighting the relationship of lesions with surrounding anatomical structures.

In our study 8 out of 10 cases were confirmed to have perforation by MDCT. Two cases of perforations' CT findings and surgical findings were not correlating.

But the sealed perforations after a time period it could not be detected. There were 2 false negative cases reported by CT, which on surgical exploration the presence of sealed perforations were identified.

In perforation cases the site of perforation can be exactly given. The early and occult perforations and confined perforations can be made out with advent of MDCT, due to its capability to detect even smallest amount of free air.

The sensitivity for bowel perforation in our study was 80%.

The accuracy rate for perforation in our study was 80% which was comparable to the study done by **Sung Hwan Kim et al.**[53] who gave an accuracy of 82% to 90% for predicting site of perforation by CT. Because in our study the 2 cases were presented very late to us after a week of diagnostic dilemma.

In our study 5 out of 73 cases had CT findings confirming urolithiasis with sensitivity of 100%. The above findings were in comparison to the data arrived by **Isabelle Boulay et al**[52] in which sensitivity was 100%.

Leschka Sebastian et al[5] stated that thin slices image reconstruction helps in identifying even sub-millimetre calculi,

In Urolithiasis, MDCT helps in confirming the diagnosis when other imaging modalities are equivocal. Subtle calculi can be detected by the presence of focal periurethral stranding and other secondary CT signs of ureteric calculi.

In our study 4 out of 73 cases had CT findings confirming cholecystitis with sensitivity of 100% which is comparable to other international studies. MDCT is useful in differenciating and detecting the complications like emphysematous cholecystitis and gangrenous cholecystitis and is the most sensitive modality as described by **L. Turturici et al**[37].

In 3 out of the 73 cases no significant abnormalities were detected by MDCT. And this was proved by diagnostic laparoscopy also.

In our study 2 cases had CT findings confirming Bowel Ischemia. 2 cases had CT findings for Volvulus, 1 case was Aortic Dissection, 2 were

Intussusception, 2 were Diverticulitis, and 2 were Aortic Aneurysm. The sensitivity of MDCT was found to be high in these cases.

Though the sensitivity was equivalent and comparable to other studies, the marginally low specificity because of the small sample size makes a limiting factor for any definitive conclusions.

Thus to conclude, MDCT has high sensitivity in detecting various pathologies in cases of inconclusive situations. MDCT is recommended when the clinical examination is tough, and investigations, like plain radiograph of abdomen and USG examinations are inconclusive.

CONCLUSION

This was a prospective study done to evaluate the “Role of MDCT in acute abdomen” in 73 patients. The CT findings were compared with surgical findings/ histopathological findings / clinical follow ups for recovery. Accurate CT diagnosis was made in 70 out of 73 cases. 59 of them underwent surgical management and 14 of them were managed medically and followed up.

In the study population 53 of them were males and 20 of them were females, age ranging from 5 to 93 years.

The common causes of acute abdomen were acute appendicitis, bowel obstruction, acute pancreatitis and bowel perforation.

In our study the sensitivity of MDCT was 97.10% and specificity was 75%. The overall Positive Predictable Value was 98.53% and negative predictive value was 60% and accuracy rate was 95.89%.

We conclude that MDCT has high sensitivity and accuracy rate. In inconclusive cases, MDCT is recommended to arrive at a definitive diagnosis.

The results obtained in the study were comparable to pioneer studies conducted worldwide. However major limitation was small sample size.

Presence of sealed perforation can be missed in CT because air with in the collection gets absorbed over a period of time and if it is sealed there will not be any presence of free fluid in the abdomen.

MDCT is the most rapid, specific, time efficient, objective and informative imaging technique. Multi-Detector Computer Tomography MDCT is a widely accepted primary investigation of choice in patients coming with intense abdominal pain.

LIMITATIONS

- As most of the patients are taken up for emergency laprotomy after USG examination, the number of patients who come for further CT examination are less in number.
- Restriction in pregnant patients for radiation exposure.
- Cost is one of the limitations.

RECOMMENDATIONS

- We would recommend that all cases of acute abdomen patients for direct MDCT examination.

IMAGES

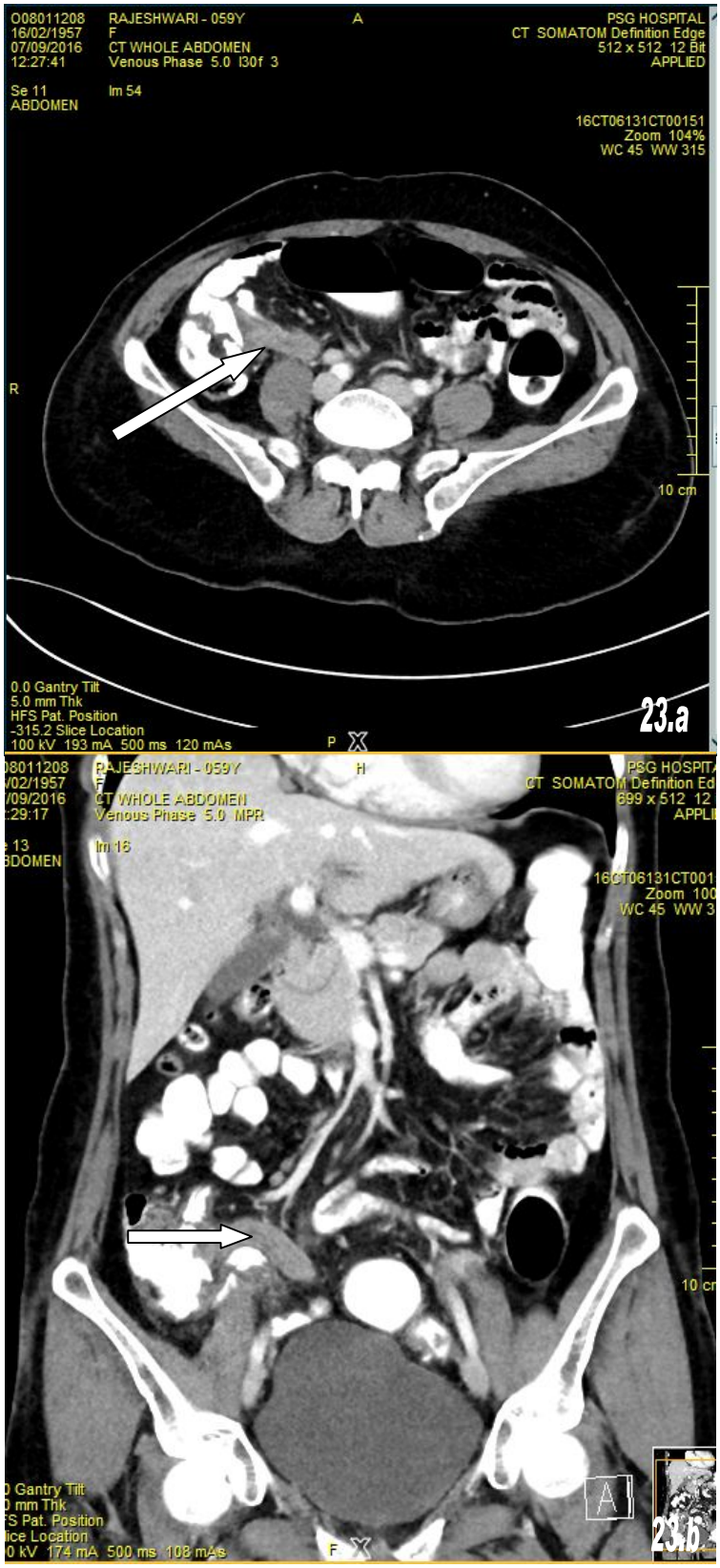


Fig :23 Axial and coronal images shows thickened and enhanced appendix in the right iliac fossa upto 12 mm thickness with tip in the right side of the pelvis. There is minimal stranding in the adjacent fat planes. No evidence of periappendiceal fluid collection. Arrow points to the thickened and enhanced appendix.

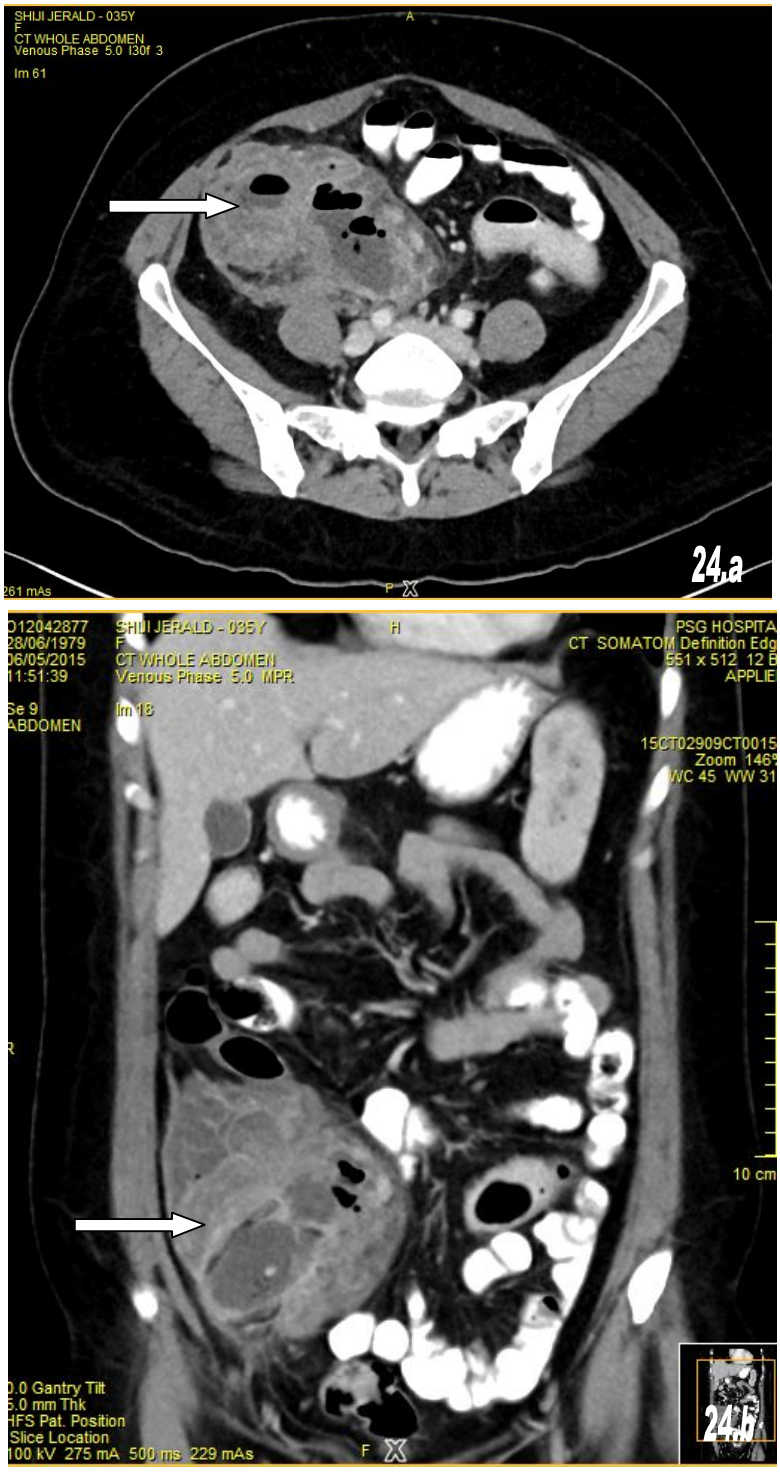


Fig:24 Axial and coronal images shows an Illdefined peripherally enhancing fluid collection extending medially upto the midline with airpockets and air-fluid level seen medial to the caecum with stranding in the surrounding mesenteric and para-colic fat planes with non-visualised appendix and with few mesenteric nodes adjacent to the collection – Suggestive of appendicular perforation with abscess formation. Arrow points to the abscess with air-fluid level formation.

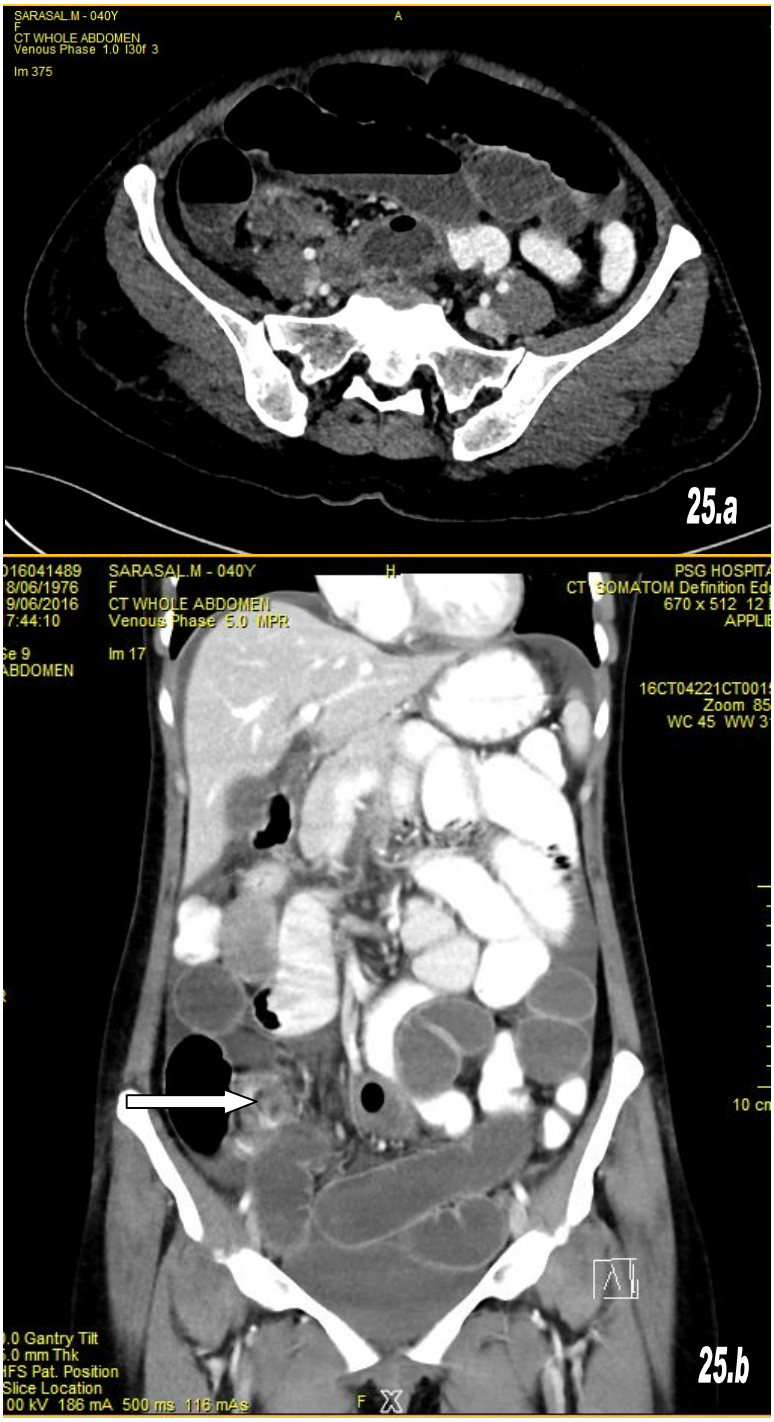


Fig:25 Axial and coronal images shows focal luminal narrowing/ obstruction in the distal ileal loop with significant dilatation and stasis of contrast in the proximal jejunum and ileal loops – Suggestive of small bowel obstruction due to adhesive band. Arrow points to the site of obstruction in the coronal image.

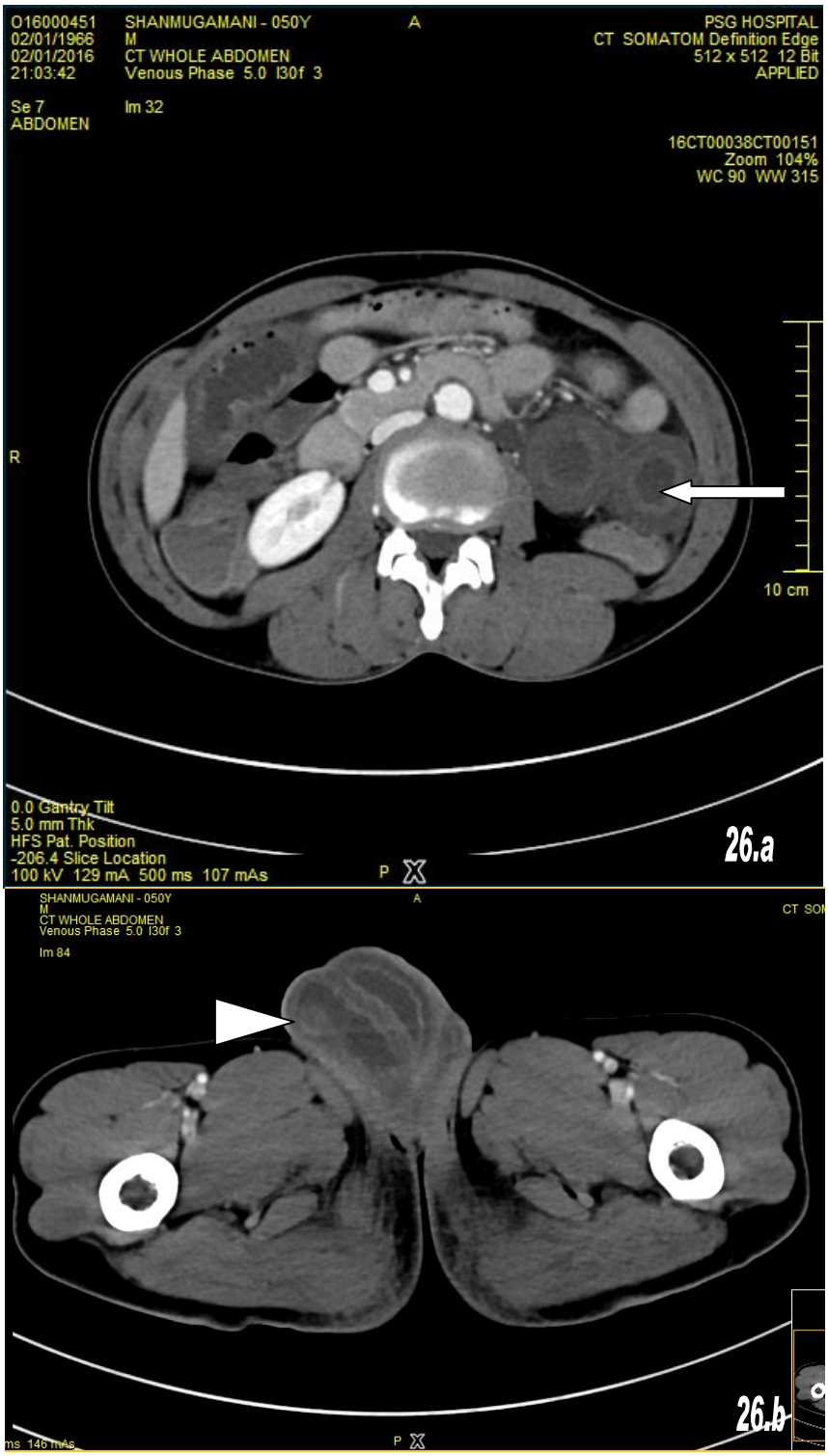


Fig: 26 Axial images of A shows dilatation of distal jejunal and proximal ileal loops with diffuse wall edema and with normal mucosal enhancement. Distal ileal loops are collapsed. B. Shows large obstructed right inguinal hernia with bowel loops as its content with minimal free peritoneal fluid. Arrow points to the edematous and dilated bowel loops in the axial image. Arrow head points the obstructed right inguinal hernia.

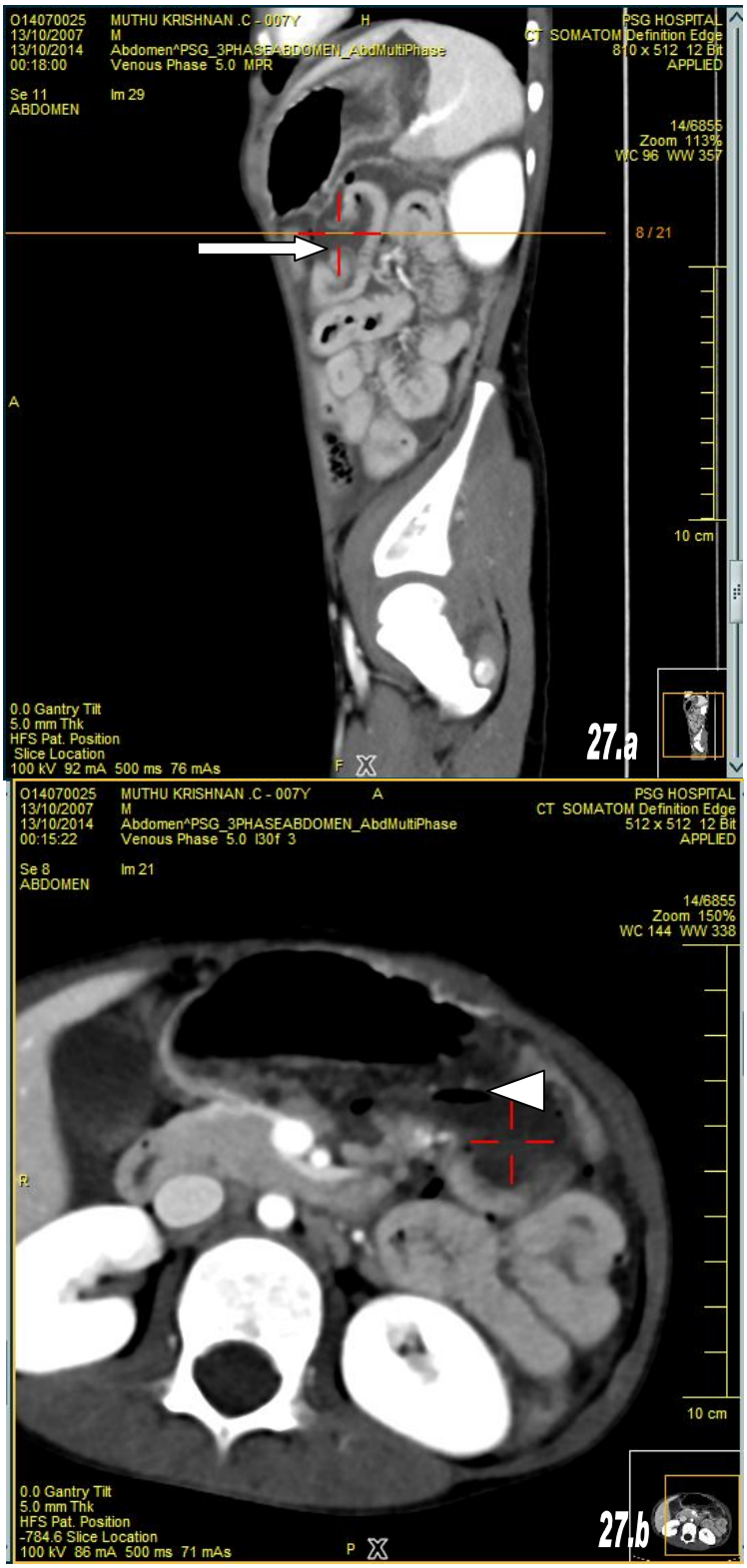


Fig: 27 Sagittal and axial images of proximal jejunal perforation show discontinuity in the anterior wall of the proximal jejunal loop at left hypochondrium/ lumbar region with surrounding hyperdense fluid collection and air pockets in it. Arrow points to the site of jejuna perforation and the arrow head points to the airpockets.

Fig:28 Free intraperitoneal air with focal discontinuity in the anterior wall of first part of the deuodenum. Suggestive of perforation. Arrow points to the prescence of air pockets.

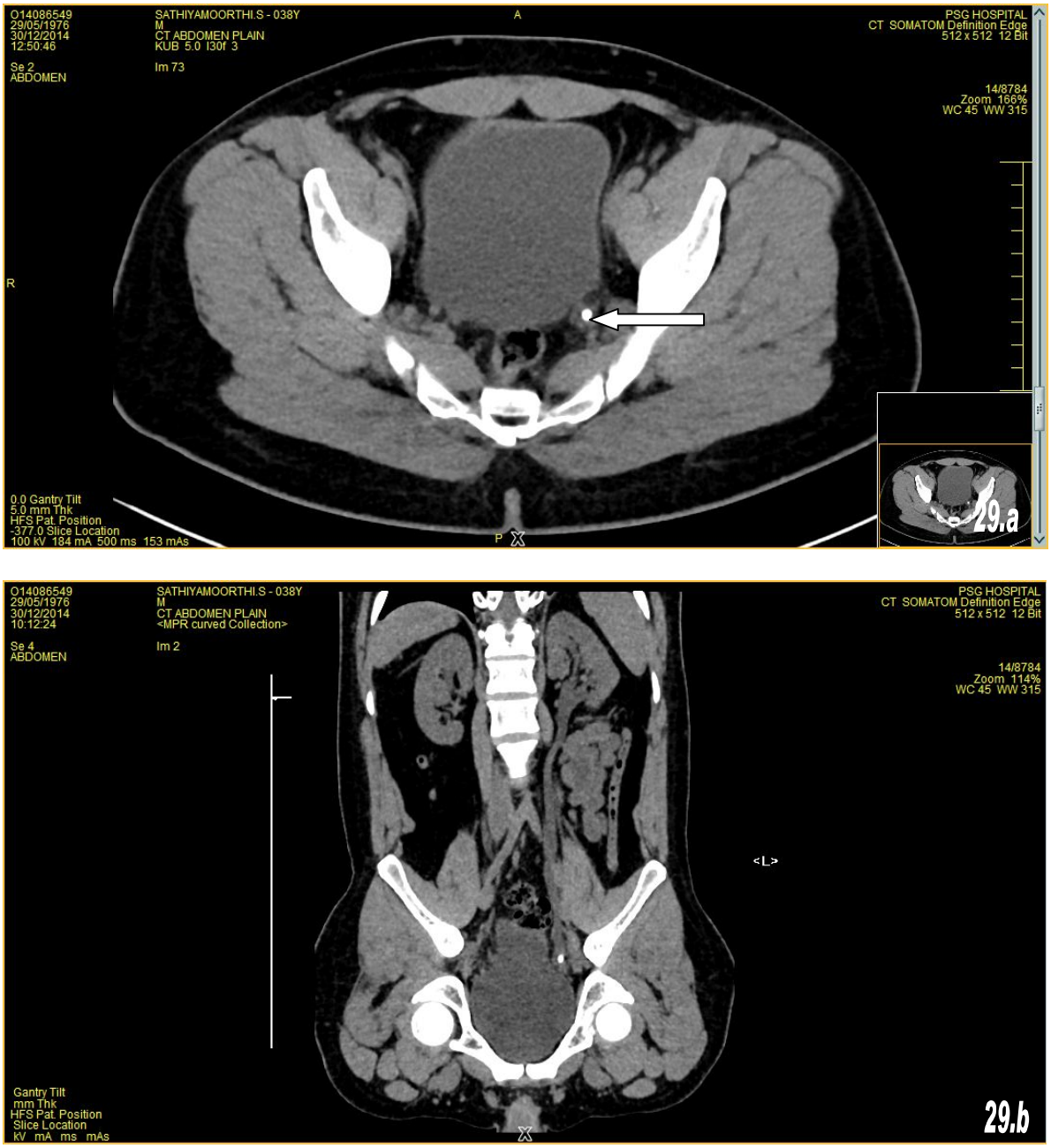


Fig:29 Axial and coronal images shows a calculus of size 7mm in the left lower ureter showing upstream dilatation of ipsilateral pelvicalyceal system and ureter. 29b) Multiplanr reformations of the coronal image shows the distal ureteric calculus. Arrow head shows calculus in the distal ureter.

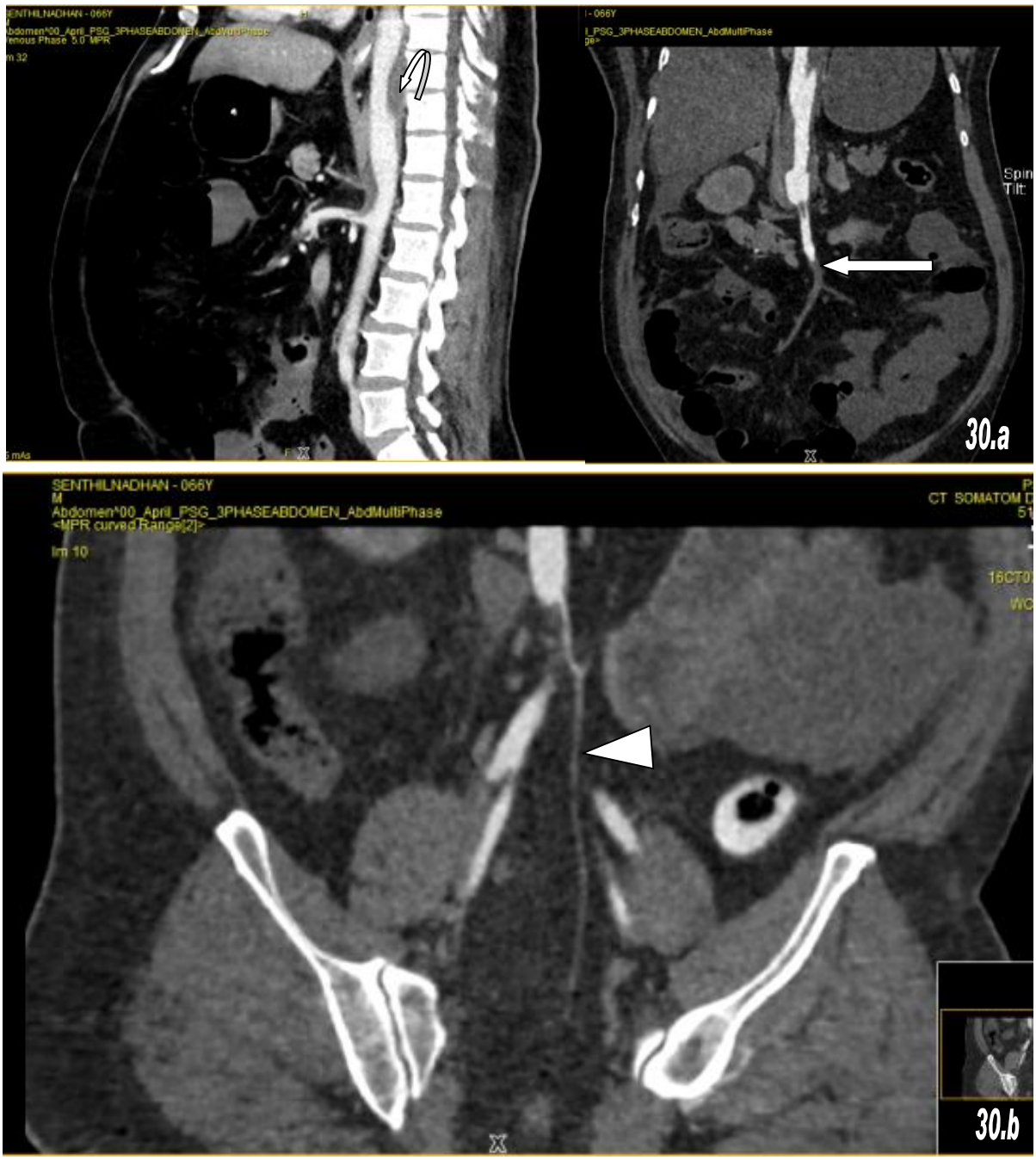


Fig:30 a)Coronal and b) sagittal multiplanar reformations shows partial thrombus in the suprarenal portion of abdominal aorta, thrombus in the origin of celiac and SMA. Distal SMA shows complete thrombosis with lack of flow to the small bowel loops causing reduced contrast in the bowel loops supplied by SMA – Suggestive of bowel ischemia. Arrow points to the complete occlusion of the distal SMA. Arrow head points to the narrowing of inferior mesenteric artery. Curved arrow points to the thrombus in the descending aorta.

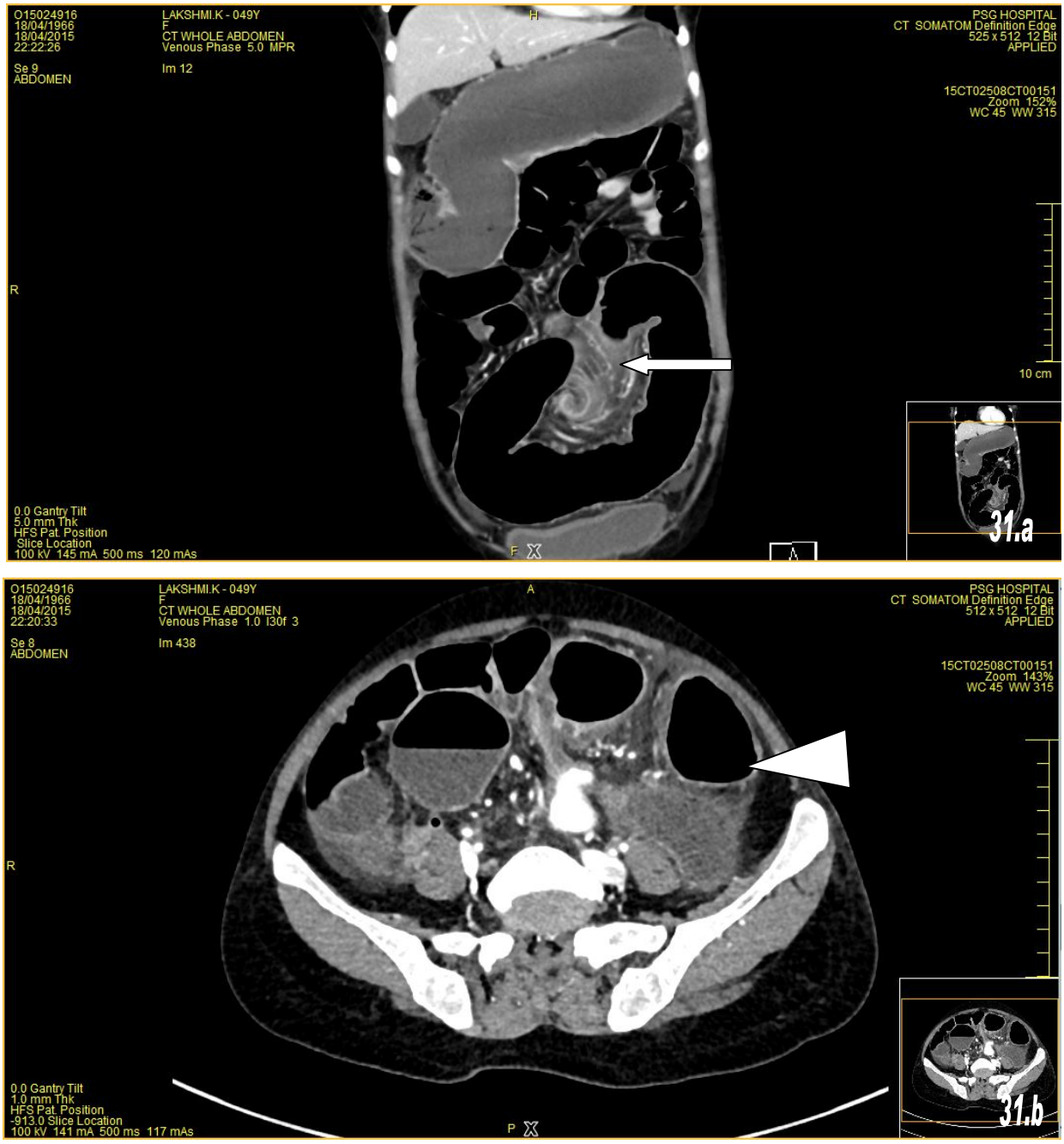


Fig:31 Coronal and axial images of sigmoid volvulus with intestinal obstruction shows diffuse dilatation of large bowel loops multiple air-fluid levels involving the ascending colon to the rectal level, transition zone in the form of twisting of sigmoid mesentry around 360degree causing swirling of the mesenteric vessels. The afferent and efferent loops of the twisted mesentry are dilated and retrograde dilataion of small bowel loops with minimal interbowel fluid. Arrow points to the twisted sigmoid mesentry with mesenteric vessels. Arrow head points to the dilated bowel loops with air fluid level.

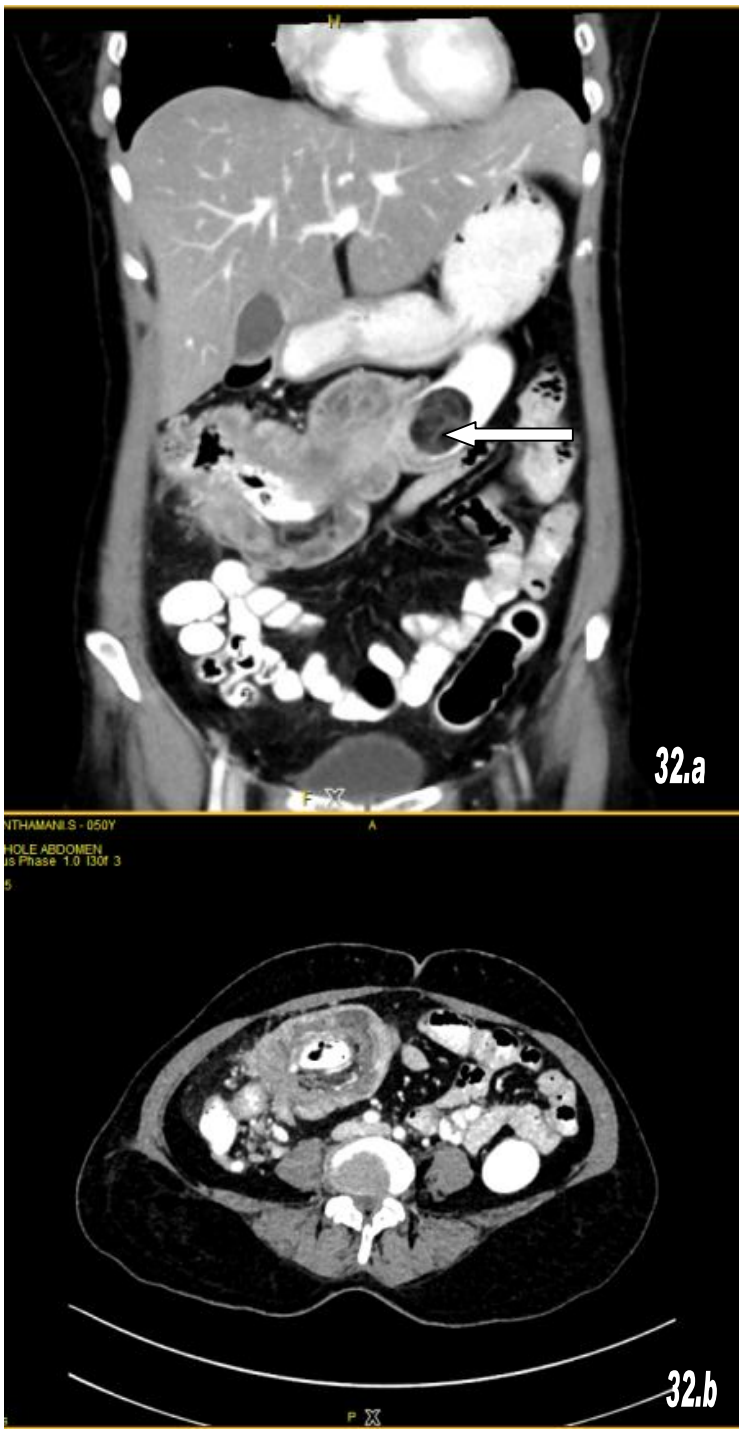


Fig: 32 Coronal and axial images show features if colo-colic intususception at ascending-proximal transvers colon with lipoma as a lead point, which was confirmed histopathologically. Bowel loops are edematous with few significant lymphnodes in the pericolic region. Axial images shows the typical reniform shape of intususception. Arrow points to the lipoma.

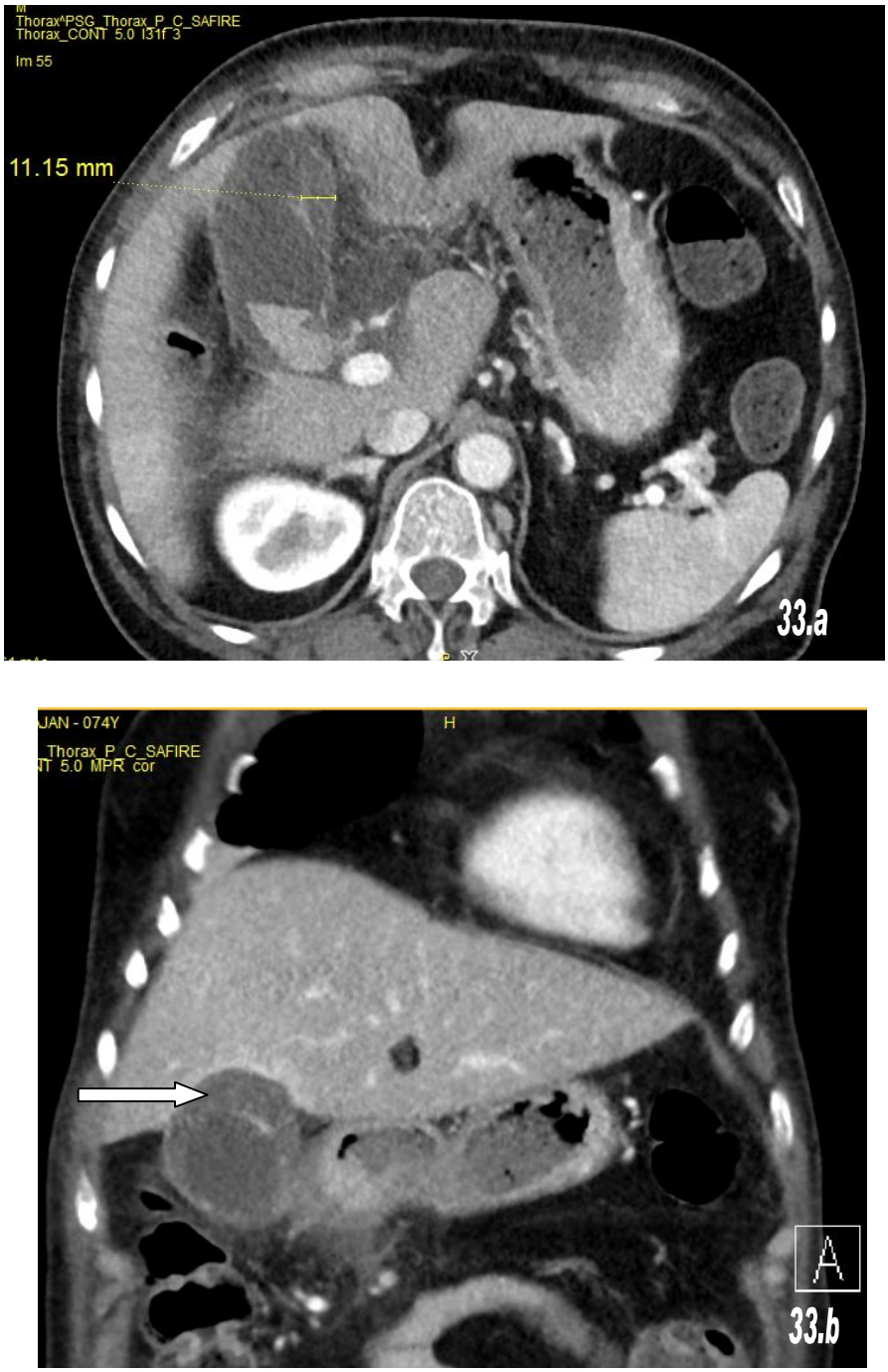


Fig: 33 Axial and coronal images shows acute cholecystitis with irregularly thickened gall bladder with decreased enhancement. Air fluid level in the GB lumen. With hyperdense layering within the lumen- Suggestive of multiple stones. Arrow points to the irregularly thickened bowel.

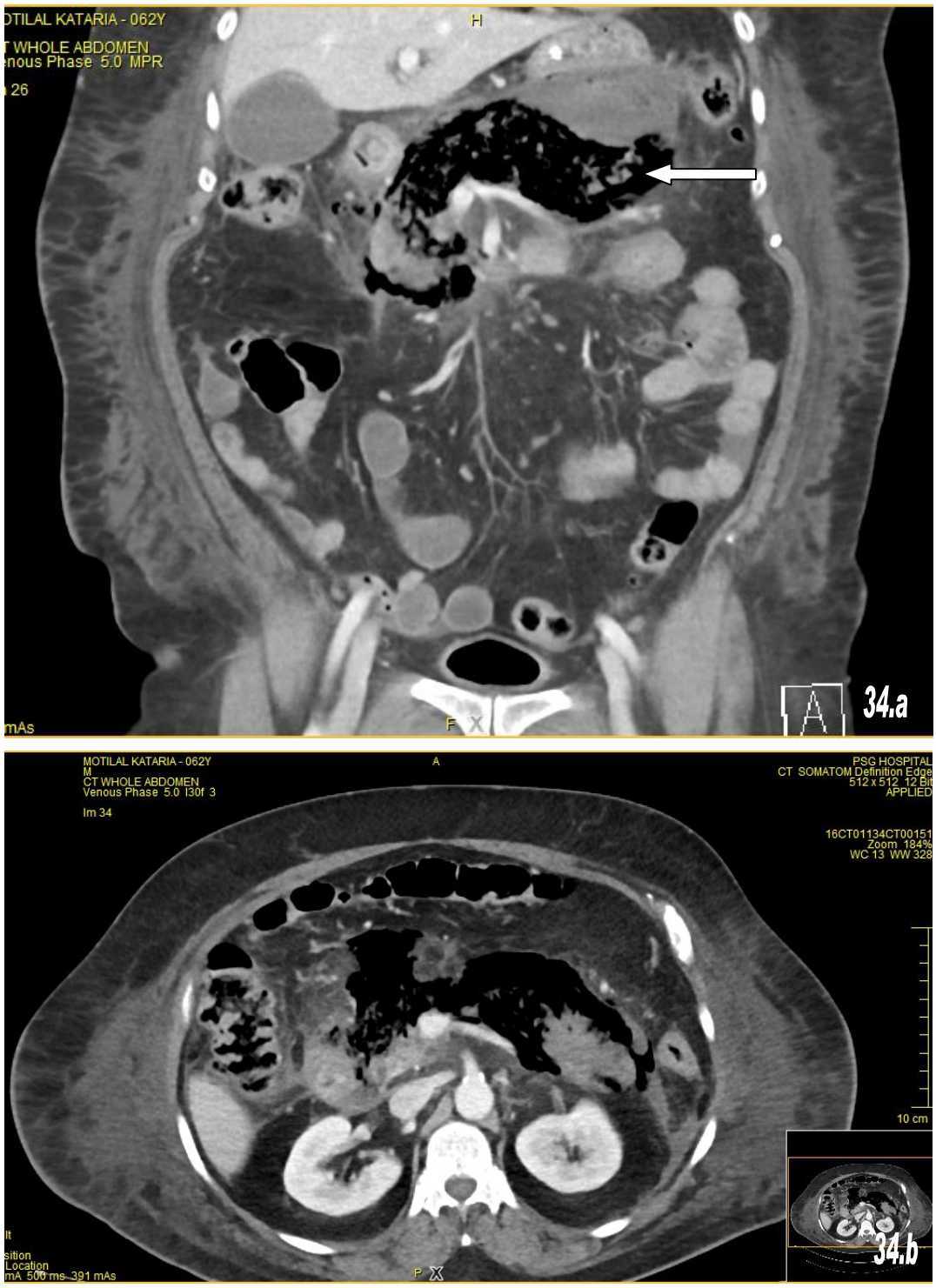


Fig :34 Coronal and axial images of acute necrotising emphysematous pancreatitis shows necrosed and replaced by air in head, neck body and tail of pancreas with the exception of tail of the pancreas.. Surrounding perinephric fat stranding and haziness is noted. Arrow points to the prescence in the pancreas.

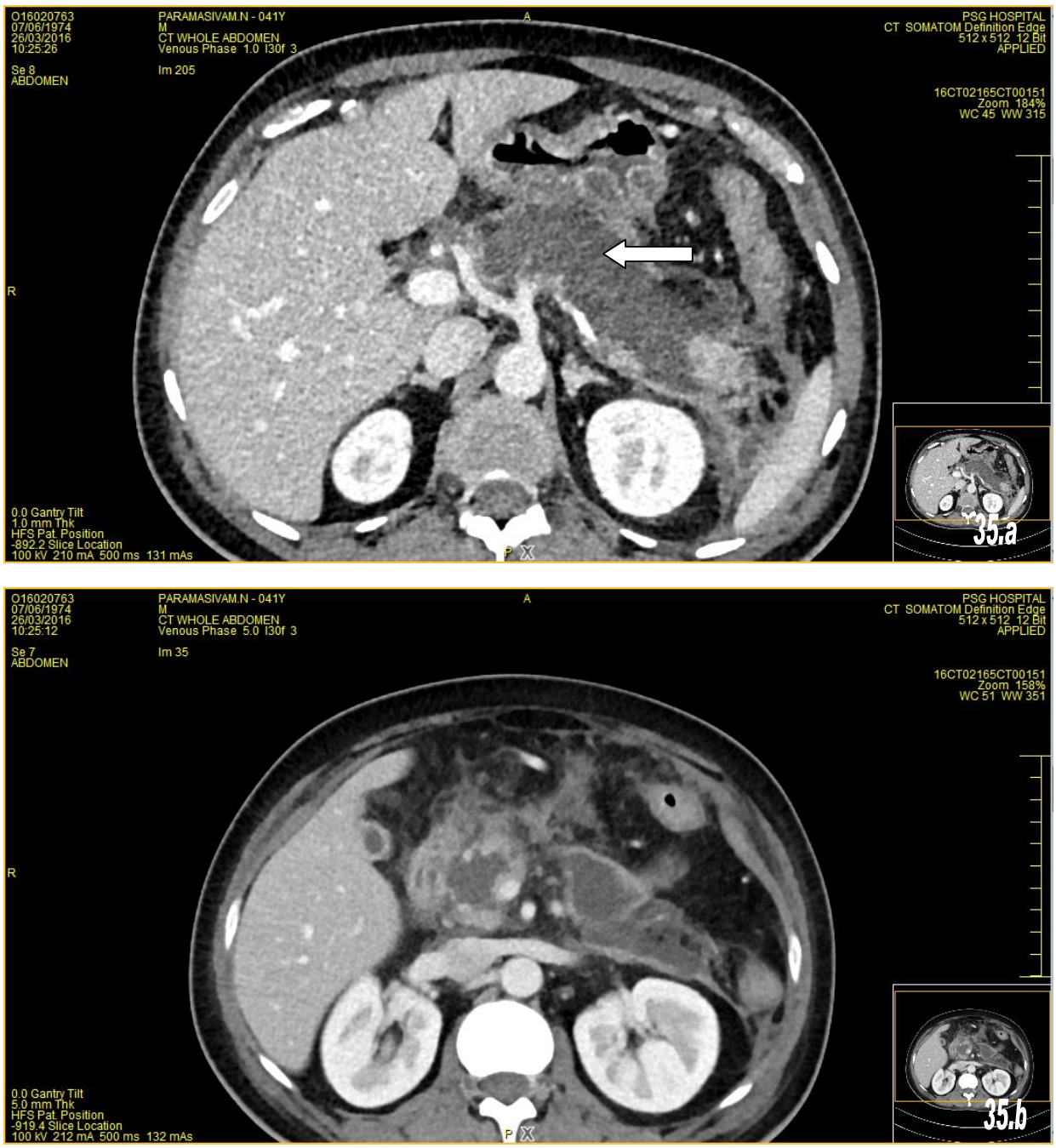


Fig: 35Axial images of acute necrotizing pancreatitis with bulky pancreas with perinephric fat stranding and more than 75% parenchymal necrosis with hypodense collection in the lesser sac. Modified CTSI: 10/10. Arrow points to the necrotic area of pancreas.

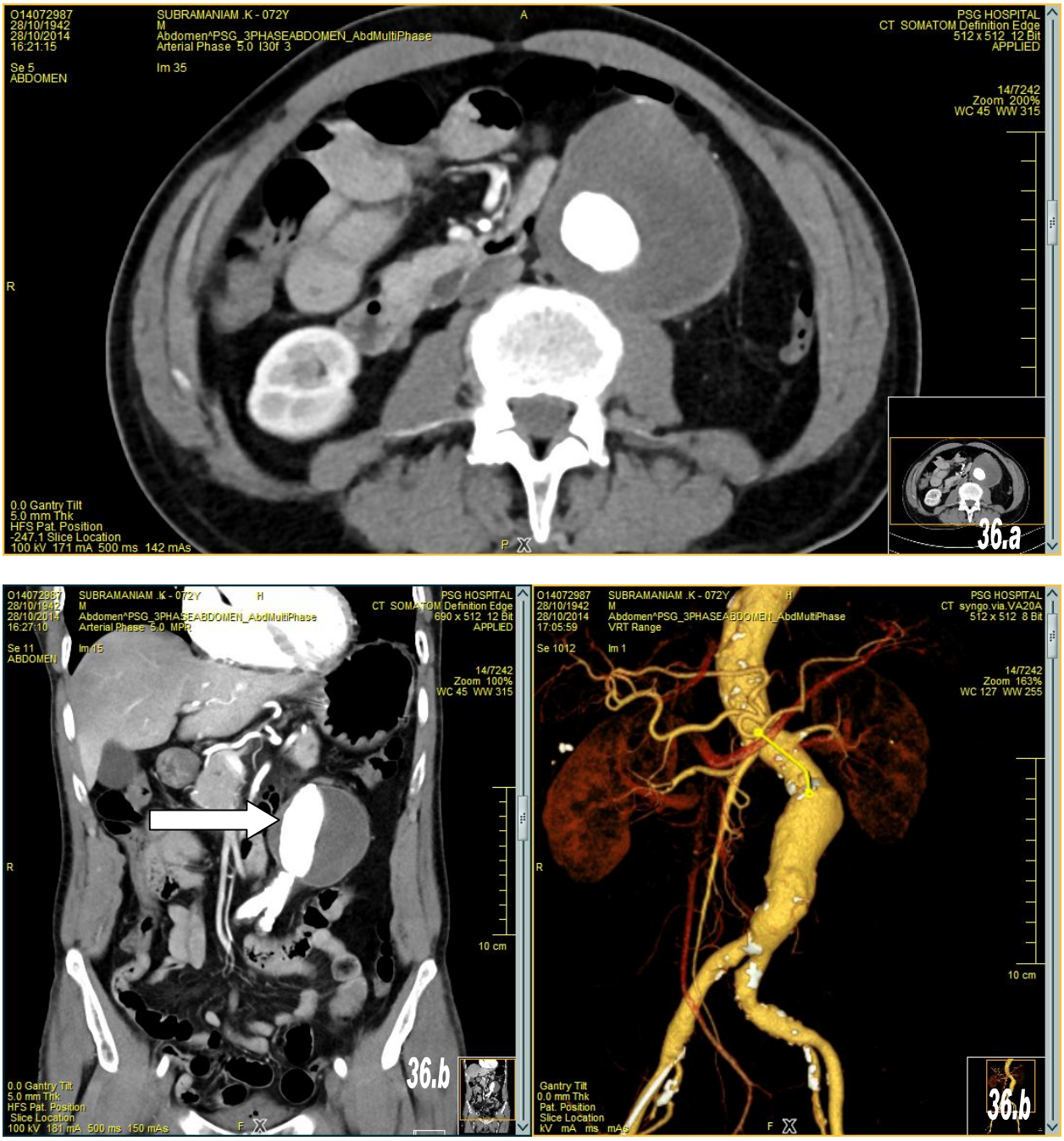


Fig: 36 Axial, coronal and VRT of the Fusiform aneurysm shows circumferential mural thrombus and patent lumen in the infra-renal abdominal aorta. Arrow points to the infra-renal aneurysm with mural thrombus.

Fig: 37 Few small diverticulum is noted in the distal part of the descending colon with surrounding mesenteric fat stranding- Suggestive of diverticulitis. Arrow points to the divertivuli in descending colon.

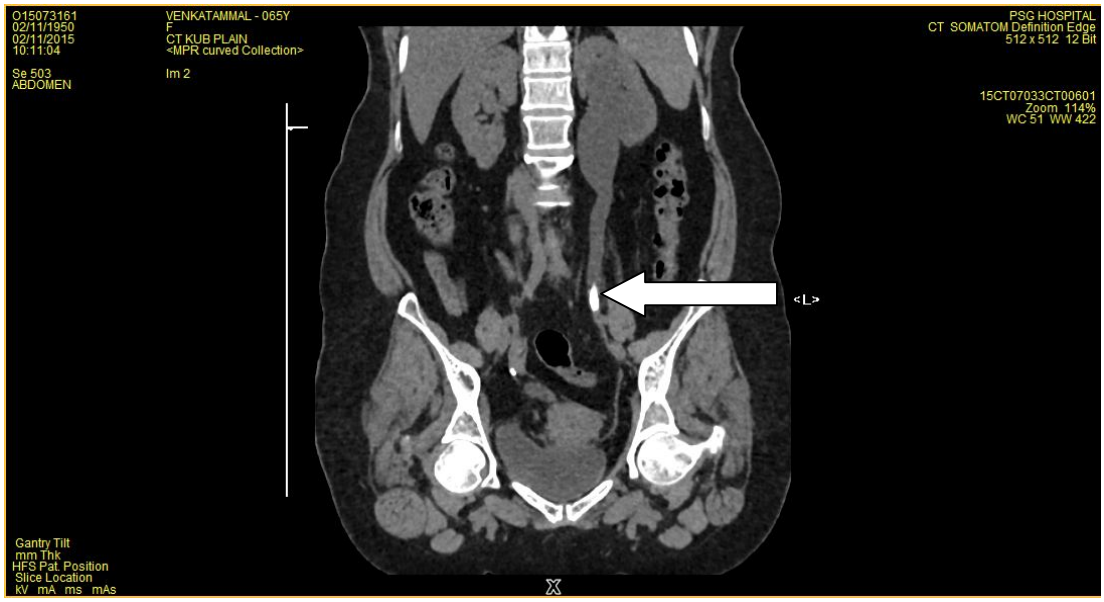


Fig 38 Left hydrouretronephrosis due to mid ureteric calculus. Coronal reformation shows the presence of mid ureteric calculus with resultant dilatation of proximal ureter and pelvicalyceal system. Arrow points to the presence of calculus in the left mid ureter.

Bibliography

1. Silen W. Cope's early diagnosis of the acute abdomen, 19th ed. New York: Oxford University Press, 1996
2. Trott AT, Lucas RH. Acute abdominal pain. In: Rose P, ed. Emergency medicine, 4th ed. St.Louis: Mosby, 1998:1888–1903
3. Bolog N, Popiel A, Oancea I, Mangrau A, Beuran M, Nicolau E. Multidetector row spiral CT (MDCT) in bowel related non-traumatic abdominal emergencies. J gastroenterol 2003; 12:319–324.
4. Frauenfelder T, Wildermuth S, Marincek B, Boehm T. Nontraumatic emergent abdominal vascular conditions: Advantages of multidetector row CT and three-dimensional imaging. Radiographics 2004; 24:481–496.
5. Leschka Sebastian, Alkadhi H, Wildermuth S, Marincek B. Multidetector computed tomography of acute abdomen. Eur Radiol 2005; 15(12):2435–2447.
6. Stephan Zangos et al.,: Acute Abdomen: Added Diagnostic Value of Coronal Reformations With 64-Slice Multidetector Row Computed Tomography Acad Radiol 2007; 14:19–27
7. Monica Mangini et al: Non-traumatic acute bowel disease: differential diagnosis with 64-row MDCT, Emerg Radiol (2008) 15:171–178
8. Rao PM, Rhea JT, Novelline RA. Sensitivity and specificity of the individual CT signs of appendicitis: experience with 200 helical

appendiceal CT examinations. J Comput Assist Tomogr 1997; 21:686 - 692.

9. Wong SK , Chan LP , Yeo A: Helical CT imaging of clinically suspected appendicitis: correlation of CT and histological findings. Clinical Radiology [2002, 57(8):741-745]
10. Bendeck SE, Nino-Murcia M, Berry GJ, Jeffrey RB Jr (2002) Imaging for suspected appendicitis: negative appendectomy and perforation rates. Radiology 225:131–136.
11. Erik K. Paulson et al: MDCT of Patients with Acute Abdominal Pain: A New Perspective Using Coronal Reformations from Submillimeter Isotropic Voxels AJR 2004;183:899–906 0361–803X/04/1834–899
12. Suri S, Gupta S, Sudhakar PJ, Venkataramu NK, Sood B, Wig JD. Comparative evaluation of plain films, ultrasound and CT in the diagnosis of intestinal obstruction. *Acta Radiol*. 1999;**40**:422–8
13. Megibow AJ, Balthazar EJ, Cho KC, Medwid SW, Birnbaum BA, Noz ME (1991) Bowel obstruction: evaluation with CT. Radiology 180:313–318
14. Peck JJ, Milleson T, Phelan J (1999) The role of computed tomography with contrast and small bowel follow-through in management of small bowel obstruction. Am J Surg 177:375–378
15. Durgesh Kumar Saini, Poras Chaudhary, Chikkala Kanak Durga, Kiran Saini : Role of multislice computed tomography in evaluation and management of intestinal obstruction Post graduate Institute of Medical

Education and Research, Dr Ram Manohar Lohia Hospital (Dr RMLH and PGIMER), New Delhi, India Clinics and Practice 2013; volume 3:e20

16. Mallo RD, Salem R, Lalani T. Computed tomography diagnosis of ischemia and complete obstruction in small bowel obstruction: a systematic review. J Gastro intest Surg 2005;9:690-4.
17. Ha HK et al (1997) Differentiation of simple and strangulated small-bowel obstructions: usefulness of known CT criteria. Radiology 294:507–512.
18. Balthazar EJ, Robinson DL, Megibow AJ, Ranson JH (1990) Acute pancreatitis: value of CT in establishing prognosis. Radiology 174:331–336
19. Beger HG, Maier W, Block S, Buchler M. How do imaging methods influence the surgical strategy in acute pancreatitis? In: Malfertheiner P, Ditschuneit H, eds. Di
20. Balthazar EJ. Staging of acute pancreatitis. Radiol Clin North Am 2002;40(6):1199–1209
21. Gong JS, Xu JM (2004) Role of curved planar reformations using multidetector spiral CT in diagnosis of pancreatic and peripancreatic diseases. World J Gastroenterol 10:1943–1947
22. B. Ginanni, F. Ruschi, L. Turturici, G. Donatelli, A. Scionti, F. Bianchi, L. Fratini, M. Tonerini, E. Orsitto; Pisa/IT: Multidetector-CT (MDCT) findings in Acute Pancreatitis (AP) 10.1594/ecr2014/C-2071
23. Baron TH, Morgan DE (1999) Acute necrotizing pancreatitis. N Engl J Med 340:1412–1417

24. Imuta M et al Multidetector CT findings suggesting a perforation site in the gastrointestinal tract: analysis in surgically confirmed 155 patients Radiat Med. 2007 Apr;25(3):113-8. Epub 2007 Apr 27.
25. Furukawa A et al Gastrointestinal tract perforation: CT diagnosis of presence, site, and cause. Abdom Imaging. 2005 Sep-Oct;30(5):524-34.
26. Hainaux B , Agneessens E , Bertinotti R , et al.. Accuracy of MDCT in predicting site of gastrointestinal tract perforation. AJR Am J Roentgenol 2006;1
27. Brofman N et al: Evaluation of bowel and mesenteric blunt trauma with multidetector CT. Radiographics. 2006 Jul-Aug;26(4):1119-31.
28. Stapakis JC et al: Diagnosis of pneumoperitoneum: abdominal CT vs. upright chest film. J Comput Assist Tomogr. 1992 Sep-Oct;16(5):713-6.
29. Strouse PJ, Bates DJ, Bloom DA, Goodsitt MM. Non-contrast thin section helical CT of urinary tract calculi in children. Pediatr Radiol. 2002;32:326-32.
30. Katz DS, Lane MJ, Sommer FG. Unenhanced helical CT of ureteral stones: incidence of associated urinary tract findings. AJR Am J Roentgenol1996; 166:1319–1322
31. Smith RC, Verga M, McCarthy S, Rosenfield AT. Diagnosis of acute flank pain: value of unenhanced helical CT. AJR Am J Roentgenol 1996; 166:97–101.

32. Preminger GM, Vieweg J, Leder RA, Nelson RC. Urolithiasis: detection and management with unenhanced spiral CT—a urologic perspective. Radiology 1998; 207:308–309.
33. Smith RC, Verga M, Dalrymple N, McCarthy S, Rosenfield AT. Acute ureteral obstruction: value of secondary signs on helical unenhanced CT. AJR Am J Roentgenol 1996; 167:1109–1113
34. Reddy RKG et al. The efficacy of unenhanced MDCT in the evaluation of nephroureterolithiasis Int Surg J. 2016 Feb;3(1):341-344
35. V. B. Monteiro , M. J. D. hrotko, M. Matias; Beja,: The role of MDCT in the evaluation of patients with acute abdomen, European Society of Radiology 10.1594/ecr2011/C-2344
36. Tack D, Sourtzis S, Delpierre I, de Maertelaer V, Gevenois PA (2003) Low-dose unenhanced multidetector CT of patients with suspected renal colic. Am J Roentgenol 180:305–311
37. L. Turturici, B. Ginanni, G. Donatelli, F. Ruschi, A. Scionti, F. Bianchi, M. Tonerini, A. Volpi, E. Orsitto; Pisa/IT: Acute Cholecystitis:Ultrasonography and CT indications in the emergency department; 10.1594/ecr2014/C-2123
38. Marco Moschetta et al: Multi-detector CT features of acute intestinal ischemia and their prognostic correlations World J Radiol 2014 May 28; 6(5): 130-138
39. A. J. Aschoff, G. Stuber, B. W. Becker, M. H. K. Hoffmann, B. L. Schmitz, H. Schelzig, T. Jaeckle: Evaluation of acute mesenteric ischemia:

accuracy of biphasic mesenteric multi-detector CT angiography Abdom Imaging (2009) 34:345–357

40. Lee R, Tung HK, Tung PH, Cheung SC, Chan FL (2003) CT in acute mesenteric ischemia. Clin Radiol 58:279–287

41. Rao PM, Rhea JT, Novelline RA, Dobbins JM, Lawrason JN, Sacknoff R, Stuk JL: Helical CT with only colonic contrast material for diagnosing diverticulitis: prospective evaluation of 150 patients. AJR Am J Roentgenol. 1998 Jun;170(6):1445-9.

42. Onkendi EO, Grotz TE, Murray JA, Donohue JHJ (2011) Adult intussusception in the last 25 years of modern imaging: is surgery still indicated? Gastrointest Surg 15(10):1699–1705

43. Begos DG, Sandor A, Modlin IM. The diagnosis and management of adult intussusception. Am J Surg. 1997;173:88–94.

44. Boudiaf M, Soyer P, Terem C, Pelage JP, Maissiat E, Rymer R. Ct evaluation of small bowel obstruction. Radiographics. 2001;21:613–624.

45. Gayer G, Zissin R, Apter S, et al. Pictorial review: adult intussusceptions - a CT diagnosis. Br J Radiol. 2002;75:185–90.

46. Sebastia C, Pallisa E, Quiroga S, Alvarez-Castells A, Dominguez R, Evangelista A. Aortic dissection: diagnosis and follow-up with helical CT. RadioGraphics 1999; 19:45-60.

47. Rubin GD, Paik DS, Johnston PC, Napel S.Measurements of the aorta and its branches withhelical CT. Radiology 1998; 206:823–829.

48. Costello P, Gaa J. Spiral CT angiography of abdominal aortic aneurysms. RadioGraphics 1995; 15:397–406.

49. Becker CD, Mentha G, Schmidlin F, Terrier F. Blunt abdominal trauma in adults: role of CT in the diagnosis and management of visceral injury. II. Gastrointestinal tract and retroperitoneal organs. Eur Radiol 1998;8:772–80.

50. Henry PC, Chabannes E, Bernardini S, Wallerand H, Bittard H. Management of severe renal trauma. Prog Urol 2002;12(4):579– 86.

51. Isabelle Boulay et al: Ureteral Calculi: Diagnostic Efficacy of Helical CT and Implications for Treatment of Patients, AJR 1999;172:1485-1490

52. Sung Hwan Kim et al: Gastro intestinal tract perforation: MDCT findings according to the perforation sites, Koren J radiol 10 (1), Feb 2009.

ANNEXURES

LIST OF ABBREVIATIONS	
2D	2 dimensions
3D	3 dimensions
AMI	Acute mesenteric ischemia
CECT	Contrast enhanced computer tomograph
CT	Computer tomography
CTSI	Computer tomography severity index
DPL	Diagnostic peritoneal lavage
GI	Gastro intestinal
HPE	Histopathological examinations
IV	Intravenous
IVU	Intravenous urogram
kVp	Peak kilo voltage
mAs	Milli ampere per second
MDCT	Multi-detector computer tomography
MIP	Maximum intesnsity projection
MPR	Multi planar reconstruction
NECT	Non-enhanced computer tomography
SMA	Superier mesentric artery
USG	Ultra sono graphy
VRT	Volume rendered technique

MASTER CHART

MASTER CHART

No	IP:NO	AGE	SEX	Appendicitis	Bowel Obstruction	Perforation	Urolithiasis	Bowel Ischemia	Volvulus	Aortic Dissection	Intussecption	Cholecystitis	Acute Pancreatitis	Diverticulitis	Aortic Aneurysm	Non Specific Abdominal Pain
1	I16000177	35	F		CT+											
2	I16008364	66	M											CT+		
3	I15016606	40	M				CT+									
4	I14026095	28	M				CT+									
5	I15018880	30	M				CT+									
6	I15011522	50	F								CT+					
7	I16024213	22	M													CTneg
8	I16015195	42	M		CT+											
9	I16014310	48	M		CT+											
10	I15031650	65	F				CT+									
11	I15011335	49	F						CT+							
12	I16028005	19	M	CT+												
13	I16014653	55	M					CT+								
14	I16015623	48	F			CTneg										
15	I14026426	5	M	CT+												
16	I15011489	39	F			CT+										
17	I15015748	45	M										CT+			
18	I15014496	20	M	CTneg												
19	I16016320	40	M			CT+										
20	I16006985	30	M	CT+												

21	I15033840	11	M										CT+			
22	I14000462	74	M		CT+											
23	I15019908	16	M	CT+												
24	I16009907	41	M										CT+			
25	I16010667	20	M		CT+											
26	I16026489	27	M	CT+												
27	I16014412	59	F		CT+											
28	I15015427	57	M									CT+				
29	I16011108	62	M										CT+			
30	I15034731	31	M										CT+			
31	I14028651	62	M												CT+	
32	I14028620	38	M								CT+					
33	I16021716	31	M										CT+			
34	I14008297	48	M			CT+										
35	I16019597	55	M		CT+											
36	I15012949	35	F	CT+												
37	I15031899	55	M									CT+				
38	I15001280	40	F				CT+									
39	I16026541	45	M			CTneg										
40	I16027936	59	M	CT+												
41	I15002196	67	F		CT+											
42	I14028697	12	F	CT+												
43	I15004178	62	M		CT+											
44	I14035801	65	F		CT+											
45	I16017076	36	M										CT+			
46	I16023814	7	M	CT+												
47	I16018190	56	F							CT+						

48	I15021644	48	F			CTneg										
49	I16017893	32	M										CT+			
50	I16025930	65	F	CT+												
51	I15034536	21	F													CTneg
52	I15019503	80	M					CT+								
53	I15014542	34	M										CT+			
54	I16016479	22	M										CT+			
55	I14017213	34	M			CT+										
56	I16016566	63	M											CT+		
57	I14005123	71	M			CT+										
58	I15006722	57	M		CT+											
59	I15028969	93	M										CT+			
60	I16026625	39	M		CT+											
61	I16005353	43	M	CT+												
62	I15006246	63	M		CT+											
63	I16021328	39	M	CT+												
64	I14031641	75	M									CT+				
65	I15031783	38	F	CT+												
66	I15029914	9	F						CT+							
67	I16024653	23	F													CTneg
68	I16012280	57	F	CT+												
69	I14028149	74	M									CT+				
70	I15031545	68	M			CT+										
71	I14028922	7	M			CT+										
72	I15022321	45	F	CT+												
73	I14030319	72	M												CT+	