Original Article

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Radiology Section

Role of MDCT in Oncological Emergencies in a Tertiary Care Oncological Centre

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ABSTRACT

Introduction: With increasing incidence of cancer in the general population along with improved treatment and better survival, many patients may need urgent care during the course of the disease and treatment. In this retrospective study at a tertiary level cancer institute, we have evaluated the role of Multi Detector Computed Tomography (MDCT) in the diagnostic work-up of patients presenting with acute conditions that would need immediate surgical or medical attention. This is probably the first study on onco-emergencies where varied acute clinical conditions involving multiple organ systems have been evaluated by MDCT.

Aim: To evaluate the role of MDCT in diagnosing the patients presenting with acute conditions in an oncological setup.

Materials and Methods: Retrospective search of the radiology department database of one year at the tertiary oncology center revealed 100 CT scans of patients who were referred to CT presenting with clinically suspected acute conditions. In addition the CT scans of those patients in which acute emergencies were detected by the MDCT, without clinical suspicion were also included. The CT diagnosis was then compared with the final clinical diagnosis made (before discharge or before death of the patient), which was a combination of clinical, imaging, biochemical and histopathological findings. This final clinical diagnosis was considered as the gold standard. In few cases where CT did not reveal any diagnosis, follow up clinical data and conclusive clinical diagnosis were studied, noted and compared with the CT diagnosis. Sensitivity, specificity, positive predictive value and negative predictive value were calculated.

Results: Among the 100 patients, 31 patients had cardiac and vascular emergencies, 30 had gastrointestinal emergencies, 18 patients had cerebral emergencies, 11 patients had thoracic/pulmonary emergencies, seven had genitourinary emergencies and three patients had musculoskeletal/soft tissue emergencies. MDCT detected lesions in 92 patients with sensitivity of 96.7% and specificity of 71.4%. Positive predictive value of CT was 97.8 % while negative predictive value was 62.5%.

Conclusion: MDCT plays an important role in the initial diagnosis of acute conditions in a known cancer patient. Hence, CT can be considered as first line of investigation in many acute conditions in these cancer patients to avoid delay in diagnosis. In an oncology set-up, MDCT can provide otherwise unobtainable information which helps in definitive diagnosis and guides the physicians for appropriate treatment which may be lifesaving and at least improve short term outcomes in these groups of cancer patients.

Keywords: Cancer, Complications, Malignancies, Oncology

INTRODUCTION

With increase in incidences of cancer, malignancy related emergencies too have gained attention and needs to be diagnosed and managed appropriately. Knowledge of the possible malignancy induced complications will expedite the process of diagnosis and hence, facilitates definitive care. Oncological emergency can be defined as an acute condition that is caused by malignancy or its treatment, which demands urgent intervention to spare the patient of death or significant permanent damage [1]. The acute condition may be due to the primary tumour itself, from the metastatic focus, due to the treatment or it may be related to a new or previously existing condition unrelated to the malignancy. Oncologic emergencies can occur at any time during the course of a malignancy, from the presenting symptom to end-stage disease [2]. In spite of the fact that the underlying neoplasm may be potentially incurable, dramatic symptomatic relief and prolongation of life is possible with timely diagnosis in these onco-emergencies. MDCT is one of the modalities which can aid detection of the acute condition anywhere in the body and is quick in scanning the entire body in a critically ill patient. In this retrospective study at a tertiary level cancer institute the effectiveness and accuracy with which MDCT aids the diagnosis of acute conditions in these diverse groups of cancer patients with varied clinical presentations and multiple system involvement was studied. This is probably the first study on onco-emergencies where varied acute clinical conditions involving multiple organ systems have been evaluated by MDCT with an aim to assess the sensitivity and specificity of MDCT in accurate diagnosis of the acute conditions in those medical and surgical emergencies mostly related to malignancy.

MATERIALS AND METHODS

Retrospective search of the radiology department database of one year (from August 2016-September 2017) at the tertiary oncology center revealed 100 CT scans of patients who were referred to CT presenting with clinically suspected acute conditions. In addition the CT scans of those patients in which acute emergencies were detected by the MDCT, without clinical suspicion were also included. The patients with incomplete clinical data were excluded and both non-contrast and contrast CT were included in the study. All studies were done with 16 slice CT scanner with multiplanar reconstructions of the images. When contrast was used, non-ionic contrast was used with oral and rectal contrasts when needed. Clinical details and suspected acute condition were noted and compared with the final CT diagnosis of the acute condition. The CT diagnosis was then compared with the final clinical diagnosis made (before discharge or before death of the patient), which was a combination of clinical, imaging, biochemical and histopathological findings. This final clinical diagnosis was considered as the gold standard. In few cases where CT did not reveal any diagnosis, follow up clinical data and conclusive clinical diagnosis were studied, noted and compared with the CT

diagnosis. The CT studies which identified the pathology or the acute condition and which correlated with the final clinical diagnosis were considered true positives. Those CT examinations which identified the condition which were finally not correlating clinically or were incorrect on clinical/surgical or biochemical examination was considered false positive. Those CT studies which were unable to identify the pathology or the acute condition which actually existed were categorized as false negative. The CT examinations which did not identify any pathology or abnormality in a patient without having any real acute clinical or surgical condition were considered true negative. The sensitivity and specificity were calculated based on the formulas as described below.

$$\text{Sensitivity} = \frac{\text{Number of true positives}}{\text{Number of true positive} + \text{Number of false negatives}}$$

$$\text{Specificity} = \frac{\text{Number of true negatives}}{\text{Number of true negatives} + \text{Number of false positives}}$$

The CT examination was performed with PHILIPS 16 slice CT or with SEIMENS EMOTION 6 slice CT machines. Reconstructed multiplanar images were studied in the axial, coronal and sagittal planes.

RESULTS

Among the 100 patients, majority of the patients were in the age group of 41 to 65 years. Male to female ratio was about 49:51 [Table/Fig-1].

Age group (in years)	M	F	Total
Up to 10	4	3	7
11 to 20	8	4	12
21 to 40	6	11	17
41 to 65	27	28	55
>65	4	5	9
Total	49	51	100

[Table/Fig-1]: Distribution of patients according to age and gender.

Among the 100 patients, 31 (31%) patients had cardiac and vascular emergencies, 30 (30%) had abdominal emergencies, 18 (18%) had cerebral emergencies, and 11 patients (11%) had thoracic/pulmonary emergencies. Seven patients (7%) had genitourinary emergencies and three (3%) had musculoskeletal/soft tissue emergencies. MDCT detected lesions in 92 patients with sensitivity of 96.7% and specificity of 71.4%. Sensitivity of CT was 96.8% and specificity was 71.4%. Positive predictive value of CT was 97.8 % while negative predictive value was 62.5%.

Cardiovascular emergencies constituted the majority of the acute emergencies comprising about 31 cases out of 100 [Table/Fig-2], while the gastrointestinal emergencies were next in line with 30 cases. Superior Vena Cava (SVC) syndrome constituted the majority of the vascular emergencies. Pulmonary embolism was seen in 4 patients with breathlessness. Cardiac tamponade was noted in three patients. One pediatric patient with juvenile nasopharyngeal angiofibroma who underwent preoperative vascular embolization had developed internal carotid artery thrombosis. Most of the remaining cardiovascular cases studied constituted mainly vascular thrombosis in various vessels. One case of acute chest pain had no detectable abnormalities on CT and later was diagnosed with myocardial infarction clinically.

Among the 30 patients of abdominal emergencies [Table/Fig-3], intestinal obstruction was seen in 11 patients, with another four patients presenting with acute abdominal pain having demonstrable intussusception on MDCT. Bowel perforation was detected in three patients. Multiple other varying diagnosis ranging from acute pancreatitis to neutropenic colitis were made on CT in rest of the patients with acute abdomen. No acute abnormality was detected in two patients in whom later clinically non- specific abdominal pain was considered.

Free floating thrombus in aorta	1
Pulmonary vein thrombus	4
SVC syndrome	7
IVC thrombosis	5
Right atrial thrombus	1
Cardiac tamponade	3
Iliac vein thrombosis	1
Pulmonary artery thromboembolism	4
Pulmonary artery and vein thrombosis	1
Pulmonary and renal vein thrombosis	1
Aortic aneurysm	1
ICA thrombosis post JNA embolization	1
No acute abnormality	1
Total	31

[Table/Fig-2]: Distribution of cardiovascular onco-emergencies.
SVC: Superior Vena Cava; IVC: Inferior Vena Cava; ICA: Internal Carotid artery

Bowel perforation with abscess	3
Intestinal obstruction	11
Ca colon post op site leak	1
Neutropenic colitis	1
Intussusception	5
Ca sigmoid with rupture and peritonitis	1
Leukemic deposits in spleen and kidney with rupture of splenic deposit and perinephric space collection	1
Ca cervix post RT with rupture and rectoperitoneal fistula	1
Ca colon post colostomy with pelvic abscess	1
Colostomy site sclerosing encapsulating peritonitis	1
Ca esophagus post op with hepatic Artery injury	1
Ca rectosigmoid post op with abscess communicating with small bowel	1
Omental infarct	1
Lymphoma post chemotherapy with acute pancreatitis	1
Total	30

[Table/Fig-3]: Distribution of abdominal (gastrointestinal) onco-emergencies.

Neurological complications were detected in total of 18 patients [Table/Fig-4] amongst whom the cord compression was seen in four patients mainly due to metastasis. About three cases each of PRES (posterior reversible encephalopathy syndrome), and acute hydrocephalus were seen. Two cases of acute stroke, two cases of subfalcine and uncal herniation were detected. No abnormalities were seen in three patients in whom one patient was later diagnosed with migraine and other with non-specific headache. The third patient presenting with seizures in which CT did not show any pathological findings, was later confirmed with electrolyte imbalance from biochemical investigations.

Posterior reversible encephalopathy syndrome	5
Cord compression (metastatic/primary)	4
Hydrocephalus and diffuse cerebral edema	4
Glioma with subfalcine and uncal herniation	2
Acute stroke	2
Straight sinus CVT	1
Total	18

[Table/Fig-4]: Distribution of neurological emergencies.
CVT: Cerebral venous thrombosis

Respiratory emergencies were seen in 11 patients. Under this category, isolated cases of varying aetiology were seen as listed in the [Table/Fig-5] ranging from post radiation laryngeal stenosis requiring urgent intubation to Acute Respiratory Distress Syndrome (ARDS) which needed immediate medical attention. One patient with chest pain with no acute abnormality on CT thorax was later diagnosed with acute myocardial ischemia.

Bleomycin induced lung injury	1
pneumomediastinum	2 (1-post tracheostomy, 1-idiopathic)
Malpositioned tracheostomy tube	1
Loculated hydropneumothorax	1
Laryngeal stenosis post radiation	1
Pneumothorax	1
ARDS	1
Surgical emphysema (post tracheostomy)	1
Laryngeal cyst with stridor	1
Ca pyriform sinus causing laryngeal stenosis	1
Total	11

[Table/Fig-5]: Distribution of pulmonary/thoracic emergencies.
ARDS: Acute Respiratory Distress Syndrome

Genitourinary complications were detected in seven patients in whom two patients were attributed to acute pyelonephritis, one infective and other attributed to chemotherapy induced nephrotoxicity. Other 5 patients had varying aetiology as listed in [Table/Fig-6]. One case of ovarian complex haemorrhagic cyst was suspected with torsion on CT in whom the torsion was not seen preoperatively.

Acute pyelonephritis	2
Ca cervix with hydeometra and ruptured urinoma	1
Tubo-ovarain abscess	1
Ovarian hemorrhagic cyst with torsion	1
Ca cx with PID with abscess	1
Recurrent germ cell tumor with bladder infiltration and urethral obstruction	1
Total	7

[Table/Fig-6]: Distribution of genitourinary onco-emergencies.
PID: Pelvic Inflammatory Disease

GCT with pathological fracture	1
Pathological fracture left humerus secondary to thyroid mets	1
Ca breast with abscess	1
Total	3

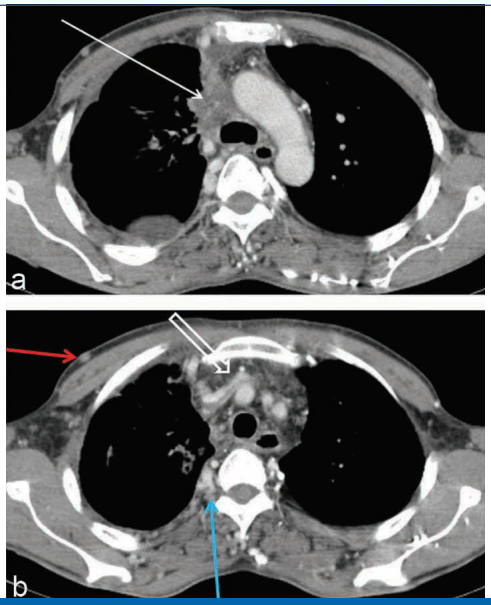
[Table/Fig-7]: Distribution of musculoskeletal emergencies.
GCT: Giant Cell Tumour

Musculoskeletal complications were seen in three patients [Table/Fig-7], two of them with acute pathological fractures. One patient with chest pain had a breast abscess in the postoperative site which was the cause of chest pain.

DISCUSSION

Oncologic emergencies are categorized as metabolic, haematologic and structural conditions [3]. Metabolic emergencies include hypercalcaemia, acute tumourlysis syndrome, hyponatremia, and lactic acidosis and haematologic emergent conditions, such as febrile neutropenia, hyper viscosity syndrome, and disseminated intravascular coagulation. These conditions are mainly diagnosed clinically with laboratory findings, very few being referred for imaging, mainly to exclude structural lesions. Hence, many of these conditions are not included in present study. Structural emergencies, on the other hand mainly rely on imaging studies for diagnosis [2-4]. These have been further classified into cardiovascular, abdominal (genitourinary and gastrointestinal), pulmonary, neurological and musculoskeletal emergencies which constitutes the majority of patients in the study. Treatment related complications, though less in numbers are one of the important emergencies in onco-radiology usually related to chemotherapy and radiation therapy. These conditions when immediately addressed with change in treatment regime will promptly resolve thus demonstrating the importance of recognition of these conditions by imaging.

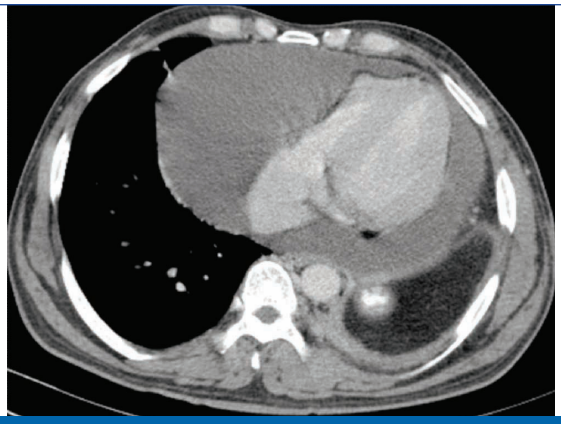
In present study, cardiovascular emergencies constituted about 31% of the emergencies. SVC syndrome [Table/Fig-8] is commonly seen in lung carcinoma. Metastatic mediastinal nodes, mediastinal germ cell tumours, and malignant thymomas are the other causes of SVC syndrome. Direct invasion or compression by the malignancy may occur with intraluminal thrombus that results in impaired venous drainage from the head, neck, and upper extremities manifesting as SVC syndrome [5]. SVC syndrome was seen in seven patients in the present study who had been diagnosed with different malignancies like lymphoma, metastatic mediastinal lymphadenopathy and germ cell tumour in whom the compression was clinically not suspected. These can be attributed to the chronicity of the thrombus in these conditions and the collaterals relieving the patient of symptoms. Inferior vena cava thrombosis was seen in five patients. Isolated cases of iliac vein thrombosis, IVC with renal vein thrombosis, pulmonary vein thrombosis and right atrial thrombus were detected on CT. Many of these were not suspected clinically. The presence of thrombus in iliac, renal veins and IVC need not always manifest clinically, as silent thrombus is well recognized.



[Table/Fig-8]: SVC syndrome in a 65 year old man with small cell carcinoma of lung. (a). shows encasement and narrowing of the superior vena cava, with a filling defect within the lumen, suggestive of thrombus (white arrow). In (b). the image taken at a slightly higher level shows the thrombus extending into the left innominate vein (open arrow). Multiple collaterals are seen along the intercostal veins (red arrow) and the lumbar veins (blue arrow).

Many cancers like pancreatic, ovarian and brain tumours are known to have high risk of pulmonary embolism and DVT [5]. However, detection of IVC thrombosis on CT will promptly initiate thrombolysis management which is crucial for prevention of pulmonary thromboembolism. Pulmonary thromboembolism were suspected in few patients and referred to CT while in few others with embolism detected on CT, there was no clinical suspicion of pulmonary thromboembolism. Gladish GW et al., reported in their study that incidental pulmonary emboli were seen in 4% of oncology patients and more frequently in those with melanoma or gynecologic tumours [5]. The presence of incidental pulmonary thromboembolism could indicate the existence of other thromboembolic disease. Cancer patients are predisposed to develop deep venous thrombosis either due to the direct thrombogenic effects of the malignancy or due to chemotherapy [3]. MDCT is extremely helpful in the detection of pulmonary thrombus due to multiplanar reconstruction. Also signs of right ventricular dysfunction may sometimes be apparent on the scan [3].

One patient with juvenile nasopharyngeal angiofibroma with preoperative embolization had left internal carotid artery thrombosis post-procedure which was clinically not suspected as the patient did not show any cerebral infarcts. CT promptly showed the hypo dense thrombus in the Internal Carotid Artery (ICA) extending into the canalicular portion of the ICA.



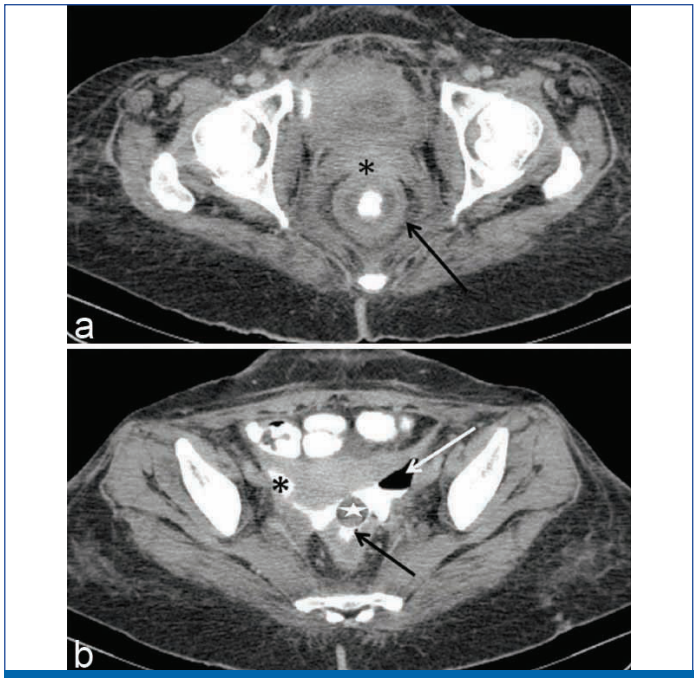
[Table/Fig-9]: Cardiac tamponade. Axial CECT of the thorax in a 60 year old male with Non-Hodgkin's lymphoma shows a large amount of fluid within the pericardial cavity (asterisk), causing compression and collapse of the right ventricle (black arrow). This patient also had bilateral jugular venous distension (not shown).

Cardiac tamponade was seen in three of our patients. Pericardial effusion [Table/Fig-9] can develop due to underlying malignancy, either from direct invasion or from metastasis. Rapid accumulation of as little of 200 mL of pericardial fluid can cause tamponade. Compression and narrowing of the cardiac chambers with signs of failure can be seen on CT. Pericardiocentesis done on emergency basis can be lifesaving.

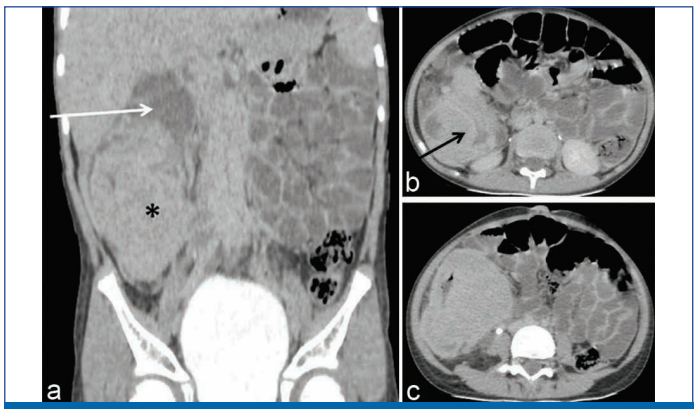
One false negative in cardiovascular complications was a patient with chest pain with no significant findings on CT, however was later confirmed with myocardial ischemia as the cause of pain. It is a well-known fact that CT is not helpful in this condition. One case of aortic aneurysm with impending rupture was seen in a patient with chest pain which was not clinically suspected. Though this can be considered non-oncological emergency, CT was helpful for further course of management.

We have separated abdominal emergencies into gastrointestinal and genitourinary emergencies in our study. Gastrointestinal emergencies constituted about 30% of the patients with intestinal obstruction seen in 11 of the 30 patients. Approximately 10%-30% of colorectal carcinoma patients and 20%-50% of ovarian carcinoma patients can present with acute intestinal obstruction. Serosal deposits, intraluminal occlusion, extra luminal compression are the usual factors causing obstruction [3]. MDCT helps in identification of the site and cause of obstruction. Chemotherapy and radiation induced bowel injury can also lead to bowel obstruction. Post-operative adhesions are well known to cause bowel obstruction [6].

Bowel perforation was seen in 3 patients who had presented with acute abdominal pain. MDCT helps in identifying the site and extent of perforation which aids surgical planning. Extravasation of the oral or rectal contrast, associated infection or abscess formation can also be evaluated. Rupture of the primary malignant mass in sigmoid was seen in one of the patients which had resulted in peritonitis. One of the patients had recto-peritoneal fistula after radiotherapy which was due to ruptured cervix communicating with peritoneum and rectum. This complicated internal anatomy was well recognized by MDCT where the clinician had no clue as to what was inside the abdomen of a patient with acute abdomen [Table/Fig-10]. Radiotherapy can cause mucosal and sub-mucosal inflammation and lead to persistent ulceration and fibrosis. Late radiation injury can present as strictures which result in intestinal obstruction, fistulas and bowel perforation [7]. One case of carcinoma colon with postoperative leak had been referred for CT which showed intraperitoneal leak. There were five cases of intussusceptions [Table/Fig-11], some of which were initial presentations of malignancies as acute abdomen. Tumours of the small intestines and colon can act as lead points and cause intussusceptions, neoplastic aetiologies being the cause of approximately 50% of all adult intussusceptions [3]; MDCT helps in detecting the cause of intussusceptions along with recognition of associated complications like bowel viability and aids planning for surgery.



[Table/Fig-10]: Ca cervix post RT with rupture, and formation of rectoperitoneal fistula. (a). Axial CECT of the pelvis shows mild heterogeneity in the cervix. Fat plane with the rectum is obscured (asterisk). Smooth circumferential thickening is noted involving the rectum, with relatively maintained mural stratification, suggestive of post RT colitis (black arrow). (b). Image taken few sections higher shows that the cervix and anterior rectal wall have ruptured, leading to communication between the rectal lumen and the peritoneum (black arrow). Note the presence of rectal contrast (asterisk), air pocket (whitearrow) and fecal matter (white star) within the peritoneal cavity.



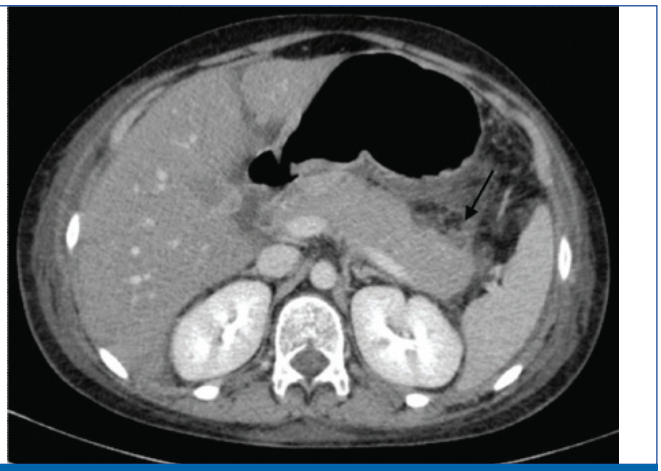
[Table/Fig-11]: Coco-colic intussusception in a seven-year-old girl with Burkitts lymphoma of the ascending colon. (a). Coronal reconstruction of contrast enhanced CT of the abdomen shows diffuse homogeneously enhancing thickening of the proximal ascending colon (intussusceptum; asterisk), which is seen invaginating into the fluid-filled distal segment (intussuscepiens; white arrow). (b). Axial image at the same level shows the target sign of intussusception (black arrow). (c). Axial CECT at a lower level demonstrates the homogeneously enhancing diffuse circumferential thickening of the large bowel wall, clinching the diagnosis of lymphoma.

Splenic rupture with perisplenic collection was seen in a leukemic patient presenting with acute abdomen. Spontaneous splenic rupture is well recognized complication of hematological malignancies which is a potentially catastrophic event that causes an acute abdomen and haemodynamic instability. Prompt diagnosis and treatment often with splenectomy is needed, with less scope for conservative management or with splenic artery embolization [8,9].

Two cases presented with postoperative acute abdomen (surgery for colonic masses) revealed infection with abscess formation which was promptly drained. One of the abscesses had communicated with the small bowel.

A case of omental infarction was seen in one of the patients with acute abdominal pain. Prompt diagnosis on CT helped in conservative management of this patient. Omental infarcts on CT typically appear as a fatty, large (>5 cm) encapsulated mass, with soft-tissue stranding adjacent to the ascending colon. Mild haziness in the fat anterior to the colon may be the only finding in

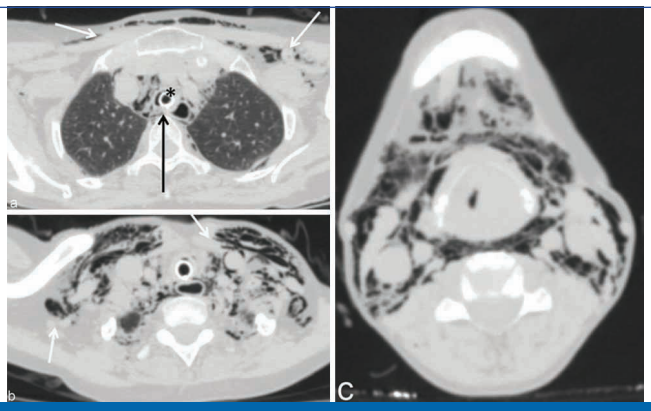
early or mild ischemic changes [10]. Chemotherapy induced acute pancreatitis was seen in a patient of lymphoma after first cycle of chemotherapy and the patient was treated conservatively [Table/Fig-12]. Chemotherapy induced pancreatitis is usually mild and self-limiting, acute fulminant pancreatitis being rare [11].



[Table/Fig-12]: Chemotherapy-induced pancreatitis in a child treated for Acute Lymphoblastic Leukemia (ALL). Contrast enhanced CT of the abdomen shows enlargement of the pancreatic body and tail, with loss of the normal lobulations (star). Peripancreatic fat stranding is seen, with surrounding fluid collection (white arrow).

One case of neutropenicenterocolitis was clinically suspected and radiologically confirmed by MDCT. Fever, abdominal pain, and diarrhea are the usual clinical symptoms with which the patient presents due to chemotherapy-induced mucosal injury and secondary super infection leading to necrosis of the bowel wall. Neutropenicenterocolitis is most commonly associated with the treatment of acute leukemia but can occur in patients undergoing myelosuppressive therapy for any cancer and in any other neutropeniccondition [12].

Respiratory system involvement was seen in 11 patients, each with varied diagnosis on CT including Bleomycin induced lung injury, pneumo-mediastinum after post-tracheostomy, malposition tracheostomy tube in soft tissues of neck, pulmonary metastases with rupture with loculated hydropneumothorax, post radiotherapy induced laryngeal stenosis, carcinoma lung with pneumothorax, ARDS vs post chemotherapy induced lung injury, extensive surgical emphysema post-tracheostomy [Table/Fig-13], carcinoma pyriform fossa with laryngeal stenosis with tracheostomy, Pneumo-mediastinum in carcinoma testis post-orchidectomy and laryngeal cyst with stridor. Primary carcinoma of the lung is the most common cause of central air-way obstruction. However, other tumours involving the tracheobronchial tree, mediastinum, and hilar regions may also result in central airway narrowing. MDCT helps in determining the cause, site, and severity of central airway obstruction [3].



[Table/Fig-13]: Extensive surgical emphysema in a 65 year old patient of carcinoma larynx, who underwent emergent tracheostomy. (a and b). Air is seen tracking through the deep subcutaneous and intermuscular planes of the chest wall (white arrows). Pneumomediastinum is also seen (black arrow). Note the tracheostomy tube in situ (asterisk). (c). Axial CT section through the neck in the lung window demonstrates air dissecting through the fascial planes of the neck and outlining the neck spaces.

[Table/Fig-14]: Bleomycin-induced lung injury in a 36-year-old woman undergoing therapy for Hodgkin's lymphoma. CT thorax in lung window shows scattered areas of ground glass opacity with mild thickening of interlobular septa, suggestive of diffuse alveolar damage (arrows).

One case of chemotherapy induced lung injury was seen [Table/Fig-14]. Chemotherapy-induced lung injury can be seen as early onset toxicity with infiltrates, pulmonary edema, hypersensitivity reaction, or pleural effusions. Late onset toxicity is seen after 2 months or more of therapy, with infiltrates or fibrosis in the lungs. Early recognition and cessation of medication can help halt the lung injury preventing the progression into fibrosis [12]. Pneumo-mediastinum as the cause of chest pain was seen in 2 cases one after tracheostomy and other being spontaneous.

Genitourinary emergencies constituted about 7 of the 100 cases. Acute pyelonephritis was seen in two patients one of whom was infectious aetiology. In the other patient, no growth was found in the urine culture and clinical features were not favorable for infectious pyelonephritis. With recent chemotherapy, nephrotoxicity of the chemotherapeutic agent was suspected [13]. Also, on further enquiry, the patient had similar complaints with lesser intensity in the previous cycle of chemotherapy on the opposite side with similar renal imaging findings on CT which strengthened the diagnosis of nephrotoxicity.

Urinoma formation due to acute rupture of dilated ureter was seen in a case of carcinoma cervix. Tubo-ovarian mass was the cause of acute pain in another patient presenting with pain abdomen. Torsion of haemorrhagic ovarian cyst was suspected on CT; however there was no torsion on laparoscopy. Pelvic inflammatory disease and pelvic abscess was seen in a patient with carcinoma cervix presenting with acute lower abdomen pain. Acute urinary retention was seen in another patient with germ cell tumour which had recurrence at the bladder base.

Out of the 18 cases of neurological emergencies, PRES (Posterior Reversible Encephalopathy Syndrome) accounted for the majority [4]. PRES is a well-described clinic-radiographic entity of encephalopathy, seizures, and other neurologic symptoms, with characteristic neuroimaging findings. PRES may be associated with chemotherapy and immunosuppressive agents used in patients with cancer. Clinical presentations may vary as is the imaging features. Though MRI appears more sensitive than CT, the latter is always the first choice as it is readily available, enables quick study in an unstable patient [14]. Cord compression was seen in 4 cases due to metastasis. Spinal cord compression occurs in 1% to 5% of cancer patients [15]. Extradural metastases from tumours involving the vertebral column is the cause of symptoms in 95% of cases, thoracic spine (70%) being the most common site as compared to the lumbosacral (20%) and cervical spine (10%). Spinal cord compression needs emergency attention as it can lead to

paralysis [15]. Hydrocephalus was seen in 4 patients who promptly needed shunting. Subfalcine and uncal herniation was seen in 2 patients with gliomas. The patients with possible brain herniation need urgent attention with appropriate treatment. CT is the first investigation of choice in an unstable patient though MR imaging is a better imaging technique when herniation is present [15]. Acute ischemia in 2 patients was diagnosed who had clinical suspicion of stroke. Cerebral venous sinus thrombosis of the straight sinus was seen in a patient with severe headache. Due to its hypercoagulable state, malignancy is known to be one of the predisposing factors of Cerebral Venous Thrombosis (CVT). Also, rarely CVT can be a paraneoplastic syndrome. It has got a favorable outcome with case fatality of less than 10% when compared to metastasis [16].

Among the musculoskeletal complications (3 cases) 2 cases were acute pain in the limb, with suspected fractures. One patient had fracture in the femoral neck due to giant cell tumour, while the other patient had a pathological fracture due to metastasis. Differentiation of stress fracture from pathological fracture is important and imaging plays an important role in the diagnosis of the same. The recognition of the pathological fracture would avoid inappropriate treatment of a stress fracture and guide necessary treatment of a pathological fracture [17]. One patient with carcinoma breast had an abscess formation in the breast, who presented with acute pain in the breast 5 days after biopsy of the breast mass. Out of 100 patients, MDCT detected lesions in 92 patients, out of which 90 patients were ultimately clinically confirmed and treated for the diagnosis provided by the MDCT. The rest of the 3 patients had been wrongly suspected or diagnosed on MDCT resulting in sensitivity of 96.7%. Amongst the two false positive cases one was a haemorrhagic complex ovarian cyst which was suspected with torsion on CT, but laparotomy revealed only a complex ovarian cyst without torsion. A case of germ cell tumour of testes was suspected with iliac vein thrombosis which on colour Doppler did not show thrombus. The thrombus which was commented on MDCT may have been artefactual due to differential opacification of the vessel by contrast as our study was single phase study. Out of the 5 true negative cases in which no abnormality was detected on MDCT, 2 patients with acute abdominal pain had indeed no significant clinical issues on follow-up and was attributed for non-specific abdominal pain. One of the acute abdomen patient was later diagnosed with dyspepsia. Two MDCT scans of the head done for severe headache were diagnosed clinically with migraine and nonspecific headache respectively. Three false negative cases were detected, one with clinical suspicion of stroke where MDCT had no abnormalities while the diffusion MR picked up the ischemic changes. Another case of acute disorientation was CT negative while the final clinical diagnosis was electrolyte imbalance. Another patient with acute chest pain where CT did not reveal any abnormality was later diagnosed with cardiac ischemia clinically. This resulted in specificity of 71.4%. The positive predictive value obtained was 97.8% while the negative predictive value was 62.5%. Thus, most of the cases where MDCT failed to detect the abnormalities were mainly in those conditions where CT had no role to play, for example in dyspepsia, nonspecific abdominal pain, migraine and electrolyte imbalance. In hyperacute infarct CT, did not detect the ischemic changes as MR diffusion had to be the first choice of investigation.

LIMITATION

The present study is done in a tertiary care oncology institute. Those patients with acute conditions in patients with cancer who were referred to other specialist centers catering the required emergency need of the patient are not included in the study. For example a patient complaining of chest pain with clinical suspicion of myocardial ischemia/cardiac cause of pulmonary oedema would have been referred to a cardiac institute and hence would not be included in the study. Few of the medical emergencies related to malignancy like metabolic complications (hypercalcaemia, hyponatremia, and hypoglycaemia), tumourlysis syndrome and anaphylactic reactions to chemotherapeutic agents are not included in the study as they are clinically diagnosed and would not demand CT imaging. As this study is done in patients with known cancer in exclusive oncology centre, there may have been increased bias of the clinicians to refer the patients to CT scan before subjecting them to other basic investigations like radiography. Hence, there may be slight overall increase in number of patients referred to CT in this study when compared to other general hospitals.

In most medical care facilities, patients with pre-existing oncologic conditions present to the common emergency room in case of acute problems. The concept of specialized acute oncology care has not been widely practiced in standard emergency care [18]. The introduction of this specialized care in oncologic emergencies with MDCT being incorporated as standard imaging tool in acute oncology would allow better diagnosis in these emergencies with improved decision making and treatment planning.

CONCLUSION

Multidetector CT has an important role in the initial diagnosis of oncological emergencies in a known cancer patient. Using CT as the first line of investigation can be recommended in many acute conditions in these known cancer patients to avoid delay in diagnosis and can be lifesaving. It can also provide valuable information which also aids in definitive diagnosis and guides the physicians for appropriate treatment which helps in improving short and long term outcomes in this group of cancer patients.

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