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Diagnostic Accuracy of CT Scan in Detection of Point of Transition of Small Bowel Obstruction

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ABSTRACT

Background: Bowel obstruction is the commonest health event of all surgical admissions for acute abdominal pain. Whenever a small bowel obstruction (SBO) is encountered, it is important to locate the transition point. Morphology of the point of transition also helps in determining the nature and cause of the intestinal obstruction. Computed tomography (CT) CT scan is the valuable diagnostic modality for the detection of the transition point of the SBO as it is rapid, noninvasive and readily available. **Objective:** To observed the diagnostic accuracy of CT scan in the diagnosing of transition points of SBO by taking surgical findings as the gold standard. **Study Design:** Cross sectional study. **Settings:** Department of Radiology, Liaquat National Hospital Post Graduate Medical Centre Karachi Pakistan. **Duration:** Six months from December 01, 2015 to May 31, 2016. **Methods:** There were 179 patients of aged between 20 and 60 years, having nausea, vomiting, abdominal pian, abdominal distension and of either gender were included. Patient demographics, clinical history and examination were done then the patient was followed by CT scan abdomen for the point of transition of SBO. The results of the CT scan were contrasted with results of the surgeries to find out the difference between the two findings in the diagnosis of point of transition and SBO. All findings were recorded on a predesigned Proforma. Analysis of data was done by SPSS version 26. **Results:** The average age of the patients was 42.82±10.64 years. Out of all patients' males were 53.63% and females were 46.37%. CT scan showed the 81.1% sensitivity, 90.2% specificity, PPV 84.2%, NPV 92.7% and 89.4% accuracy in the diagnosis of the transition points of SBO. **Conclusion:** In the study conclusion CT scan proven to be valuable diagnostic tool in the transition points detection among patients of SBO.

Keywords: *Small intestinal obstruction, CT scan, Transition point.*

INTRODUCTION

The small intestinal obstruction is responsible for around 12–16% admissions of the surgical emergency and around 20% of procedures from emergency surgeries.[1] It can happen anywhere along the GIT's length, like small intestinal obstructions, large bowel obstructions or gastroduodenal obstructions.[2] SBO obstruction is the typical clinical scenario for gastrointestinal surgeons, and it's critical to know how to evaluate and treat cases of suspected small intestinal obstruction and large intestinal obstruction. The small bowel accounts for around 75% of all bowel mechanical obstructions.[3] In Pakistan as well as other tropical nations, intestinal obstruction is prevalent, but the majority of these cases reached late. Small bowel obstruction develops secondary to functional or mechanical obstruction, preventing normal transit of its contents. It has two types: dynamic and adynamic. Furthermore, when contrasted to adynamic obstruction, persons with dynamic obstructions were considerably more likely to have good outcomes.[4] Its causes include intra-abdominal adhesions, neoplasm, herniation, inflammatory bowel disease, intussusception, tuberculosis, inflammatory strictures and volvulus. The

commonest causes of the small intestinal obstruction are adhesions linked to the prior surgery, clinically, it presents as abdominal pain, vomiting, nausea and constipation.[5]

The such disease can be partial or complete, and based on the diameter discrepancy between dilated and non-dilated bowel segments, the severity of obstruction can be mild, moderate, or severe. A Greater than 50% obstruction is considered a high grade. Whenever small bowel obstruction is encountered, it is important to locate the transition point, which is defined as a sudden alteration of the caliber between the collapsed distal and dilated proximal bowel loops. Its criteria include the occurrence of the fluid-filled/air, dilatation of the small bowel loops with 2.5 cm in diameter. Morphology of the point of transition also helps in determining the nature and cause of bowel obstruction.[6,7]

Because the intestine is a tubular, complex and thin-walled organ with a cartable and tortuous path, imaging it is difficult. Various imaging techniques are used for it with each having different accuracy in the determination of point of transition.[8] Abdominal radiography is diagnostic in 50%-60% of cases and is an initial modality because of its sensitivity in detecting high-grade obstruction, as well as its widespread advantages such as low cost. However, it remains inconclusive and the cause is rarely detected.[8]

Sonography has a sensitivity of 89% and can identify gastrointestinal tract obstruction related to determining the root causes of GI tract obstructions.[9] However, other causes are rarely detected and it is operator-dependent. MRI was found to be a viable and promising method for diagnosing SBO strangulation, with excellent sensitivity 100% and 93% specificity. Nevertheless, when compared to CT, MRI is less convenient (especially at night), takes longer to scan, and may not be as accurate in determining the cause of SBO.[10] Without the identification of strangulation in the case of SBO, the primary goals were to determine the degree of obstruction, or the transition zone' with the small bowel loops dilatation proximally and compressed loops distally, as well as the reason of obstruction. CT helps in determining strangulation. Its signs include thickening and raised the weakening of bowel wall. Furthermore, it was considered to have a significant sensitivity, specificity, and accuracy for detecting small intestinal blockage.[11]

Closed loop obstructions giving the appearance of a pseudotumor or coffee bean sign can also be found. CT is the technique of choice for detecting the point of transition of small bowel obstruction as it's fast, painless, and easily available. It also enables the visibility of extramural locations. CT is beneficial in determining the degree and source of blockage, as well as the consequences that necessitate emergency surgery, in addition to verifying the diagnosis of obstruction. According to a study by Idris-M, for diagnosing the point of transition, CT has a sensitivity of 93% specificity of 67% and diagnostic accuracy of 92%.[8] Another study however, demonstrated sensitivity and specificity of 93% and 90%, respectively.[7] To the best of my knowledge, very little local data is available demonstrating the accuracy of CT scan to diagnose transition point of small bowel obstruction. Furthermore, keeping in mind, the above-mentioned statistics regarding sensitivity and specificity, there seems to be some degree of controversy and disparity in the data available from previous studies. Hence, such a study was done to prove the accurate statistics on the topic. Due to the paucity of local literature available, the study will serve as a valuable addition to the specialty for academic purposes but also help in surgical decisions and guide further clinical management of the patient.

METHODS

This was a cross sectional study performed at the Department of Radiology, Liaquat National Hospital Post Graduate Medical Centre, Karachi Pakistan with the duration of Six months from December 2015 to May 2016

The study included 179 participants using a non-probability, consecutive technique of sampling. The sample size was calculated by considering sensitivity 93%[7], Specificity 67%[7], Prevalence 20%[1], precision level 7% (for sensitivity) and 10% (for specificity) and confidence level 95%.

All the patients who were referred by the consultant for the diagnosis of point of transition of SBO to Radiology department and underwent surgical management, aged between 20 to 60 years, having nausea, vomiting, colickly abdominal pian, abdominal distension and of either gender were included. All the von consenting patients, operated before the CT scan examination, patient with history of allergic reactions / allergy to IV contrast medium and poor renal function indicated by serum creatinine level >1.5 mg/dl were excluded.

The goal of the study including process, hazards, and advantages were all described to the participants, and informed consent was obtained. The patient demographics, clinical history and examination was done by principal investigator then the patient was followed by CT scan abdomen for transition points of SBO. The CT scan examination was performed by the principal investigator under the supervision of consultant radiologist, having post fellowship experience of at least 5 years. Unless clinically contraindicated, CT scans were routinely conducted with IV contrast material. Contrast material was provided orally two hours prior to scanning

and rectally two hours prior to scanning. In all cases, sagittal, multiple axial and coronal scans were performed with a 4 mm slice thickness at 4 mm intervals from the diaphragmatic dome to the symphysis pubis. CT scan findings was assessed and interpreted by an experienced radiologist with experience more than 5 years. CT scan findings included bowel loops dilatation, abrupt or progressive change in luminal diameter in the intestine, and appearance of any intestinal wall thickening or focal mass lesions at or near the site of obstruction. On the CT scans of each subject, an attempt has been made to identify the point of transition and the reason of obstruction. All the CT images were evaluated by two radiologists, and if there was any initial disagreement, a consensus was obtained. The results of the CT scan were contrasted with results of the surgeries to find out the difference between the two findings in the diagnosis of point of transition and small bowel obstruction. They were smooth shiny dilated proximal bowel loops with collapsed wrinkled distal bowel loops. It can also be identified by locating any lead point, such as stricture, mass, hernia and intussusception etc. All demographics, clinical history, CT scan and surgical findings were recorded by principal investigator on a predesigned Proforma. For data collection and analysis, the Statistical Package for Social Sciences version 26 was utilized.

RESULTS

179 patients who were referred by the consultant for the detection of point of transition of small bowel obstruction to the radiology department were studied. The average age of the patients was 42.82 ± 10.64 years. Out the 179 cases, 96(53.63%) were male and 83(46.37%) were female. Nausea was the commonest clinical finding that was observed in 62.6%, followed by vomiting 57%, constipation 54.7% and abdominal pain 52%. (Table 1)

Table 1: Descriptive statistics of the age, gender and clinical features of the patients (n = 197)

Variables		Statistics
Age (Mean+ Std. Deviation)		42.82±10.64
Gender	Males	96 (53.63%)
	Females	83 (46.37%)
Clinical features	Nausea	112 (62.6%)
	Vomiting	102 (57.0%)
	Abdominal pian	93 (52.0%)
	Constipation	98 (54.7%)

CT scan and surgical findings reading transitions point detection are presented in figure table 2. CT scan-positive findings in transition points detection were observed in 39.1% cases and 37.43% diagnosed by surgical findings. The CT scan diagnostic accuracy in the transition points diagnosis observed with 81.1% sensitivity, 90.2% specificity, PPV 84.2%, NPV 92.7% and 89.4% of diagnostic accuracy. (Table 2)

Table 2: CT scan diagnostic accuracy in diagnosis of transition point of SBO (n = 179)

CT Finding	Surgical Findings		Total
	Positive	Negative	
Positive	59 (TP)	11 (FP)	70(39.1%)
Negative	8 (FNs)	101(TN)	110(60.9%)
Total	67(37.4%)	112(62.6%)	179(100.0%)
Sensitivity	=59/67	=88.1%	
Specificity	=101/112	=90.2%	
PPV	=59/70	=84.3%	
NPV	=101/110	=92.7%	
Accuracy	=59+101/179	89.4=%	

DISCUSSION

Small bowel obstruction developed when the usual flow of intestinal contents is obstructed. It is a prevalent clinical disorder that causes the pain of abdomen, accounting for about 20% of all acute abdomen emergency admissions. It's also one of the most common intestinal diseases that leads to surgical consultation.[12,13] Small-bowel obstruction (SBO) remains a significant source of morbidity and mortality, accounted for 12–16 percent of hospitalizations for the assessment of acute abdominal pain.[14] Early and correct diagnosis is essential for effective therapy. complete medical history, physical examination, and radiographic investigation are all part of a thorough diagnostic strategy. CT scans have lately gained popularity because they are thought to improve evaluation and thereby aid therapy of intestinal obstruction.[15] In this study average age of the cases was 42.82±10.64 years and 53.63% were male and 46.37% were female. Consistently Shakil O *et al*[15] reported that the average age of the study subjects was 46 ±19 years and 64% were males. In another study of Hassan M *et al*[16] also reported that the age range of the study participant was 6 to 82 years old, with an average age of 50 20 years and 53 were males and 47 were females out of a total 100 cases.[15] In the study of Barnett RE *et al*[15] demonstrated higher average age was 66 years 97% were males.

In this study diagnostic accuracy of CT scan in relation with Sensitivity, specificity and Positive Predictive Value was 81.1%,90.2% and 84.2% respectively. In line of this study Li Z *et al*[9] reported that the CT sensitivity and specificity in the diagnosis of small bowel obstruction were 91% and 89% respectively. In the study of Shakil O *et al*[15] reported that CT scan showed good sensitivity 93% and 93% specificity followed by positive predictive value for identifying bowel obstruction was 89%. Two decades ago, standard CT scan imaging modality became was the best diagnostic tool for evaluating the obstruction of intestine.[15] Although several studies have demonstrated

the utility of CT in verifying diagnosis (both at the site and at the spinal level) and determining the etiology of small bowel obstruction, according to these investigations, the sensitivity ranges from 94% to 100%, while the accuracy ranges from 90% to 95%.[9,16,18] CT scanning can detect symptoms of strangulation and volvulus, as well as the location, degree, and severity of obstruction.[16] CT's present role in the treatment of SBO is to identify obstruction, describe the etiology and likely the obstruction's site, and distinguish non-strangulating from strangulating obstruction.[19] Evaluation of the CT is the applicable with the 83-100% sensitivity and the 61-93% specificity.[19-21] All of our patients in this series received surgical findings as the gold standard. Transition zone's identification is the examinational 1st phase for the cases having small intestinal obstruction, and it typically provides a valuable assessment of the origin of the bowel obstruction, as also reported by Idris M *et al*[7] and they found 85 percent in their study subjects the etiology of small bowel obstruction was appropriately identified. Like them concentrated in this study on detecting the POT of small intestinal obstruction precisely because it can enable operating surgeons find the planned surgery site preoperatively, which can aid in pre-surgical planning for such patients.[7] Our findings demonstrate that CT is a highly sensitive method for making this diagnosis.

CONCLUSION

The study concluded that the CT scan was observed to be the valuable in the diagnoses of the small bowel obstruction with the high sensitivity and specificity, and it could be used as a preoperative localizing tool for detecting the point of transition of SBO, that could aid surgeons in preoperative surgical planning and determined the accurate bowel location to be operated on among individuals having small bowel obstruction.

LIMITATIONS

This was a small sample size and single center study.

SUGGESTIONS / RECOMMENDATIONS

Further large-scale studies are recommended.

CONFLICT OF INTEREST / DISCLOSURE

No conflict of interest.

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