

# DIAGNOSTIC ACCURACY OF MULTI-DETECTOR CT SCAN IN DETECTION OF 'POINT OF TRANSITION' IN SMALL BOWEL OBSTRUCTION

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## ABSTRACT

**INTRODUCTION:** Intestinal obstruction is the cause for 20% of all surgical emergencies. Plain radiograph is the first radiological investigation which is done after clinical examination however it doesn't offer diagnosis in difficult scenarios. In such cases, MDCT scan can offer diagnosis along with the cause and associated complications if any are present. **METHOD:** The objective of the study is to determine the diagnostic accuracy of multi-detector CT scan in detection of point of transition of small bowel obstruction by taking surgical findings as gold standard. **RESULTS:** MDCT findings showed 93 (66%) patients with point of transition. Diagnostic accuracy of MDCT findings taking surgical findings as a gold standard shows sensitivity as 89%, specificity 90.2%, positive predictive value 95% and negative predictive value 77%. Overall diagnostic accuracy was found to be 89% (p-value<0.005). Stratification was done to see the effect of age and gender on the outcome. Chi-square test was applied. **CONCLUSION:** MDCT offers diagnosis in cases where small bowel obstruction is uncertain. It has good sensitivity as well as specificity.

**Keywords:** Point of transition, Multi-detector CT scan, small bowel obstruction

## Introduction

Intestinal obstruction accounts for 20% of all surgical emergencies.<sup>1</sup> There can be various causes accounting for this clinical moiety. In around 75% of cases of acute bowel obstruction, small bowel is the most commonly involved. It presents with abdominal pain which is generalized, emesis and absolute constipation depending on the level of obstruction.<sup>2-4</sup>

The first investigation among patients with intestinal obstruction is a plain radiograph. However in some cases the diagnosis is difficult to make on the basis of clinical examination and plain abdominal radiograph. The sensitivity of plain radiograph is 40%-80%. In cases with difficulty in making diagnosis of intestinal obstruction on the basis of plain radiograph computed tomography (CT) scan is used to determine the cause and level of obstruction.<sup>5,6</sup>

For management of patients with intestinal obstruction, the assessment of transition point is important which is a zone of tissue between proximally dilated and distally collapsed tissue. For better visualization of the transition point new diagnostic techniques have been introduced. One of these include multidetector CT scan. This modality allows the formation of thin section of the intestine which allows better visualization.<sup>7</sup> The sensitivity and specificity of MDCT test is said to be 87% and 90% respectively.<sup>8</sup>

With advancement in the field of surgery, imaging is the primary focus in the management of patients with small bowel obstruction. The results of multi-detector CT scan can modify the surgical outcome of these patients. The multi-detector CT scan doesn't require the use of contrast agents. The fluid retained within

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the intestine serves as natural negative contrast agent. It can be used to analyze the severity of obstruction, the cause of obstruction and the analysis of the transition point of the obstruction.<sup>9-11</sup>

Adhesions is one of the most common causes of small bowel obstruction. These cannot be visualized using CT scan and hence multi-detector CT scan comes into play. It further helps in identifying associated complications of small bowel obstruction such as small bowel necrosis, ischemic changes or intestinal perforation.<sup>12</sup>

## Material and Methods

The objective of the study is to determine the diagnostic accuracy of multi-detector CT scan in detection of point of transition in small bowel obstruction in public sector hospital of Karachi Pakistan and to compare the results with international studies and contribute to literature by locally produced data in a public sector hospital of metropolitan city of Pakistan.

For diagnostic accuracy of multi-detector CT scan in detection of point of transition in small bowel obstruction surgical findings seen later were taken as a gold standard to compare the MDCT findings.

This is a cross-sectional study. This study was conducted at the department of Diagnostic Radiology Jinnah Postgraduate Medical Centre. The duration of this study was six months. Non-probability sampling technique was used. Sample size was calculated using OpenEpi. While calculating the sample size we have expected sensitivity of 87%, specificity of 90%, prevalence 75%, desired precision 10 % and confident level as 95%. On the basis of expected values the estimated sample size is 141 patients.

All patients with age range between 30-65 years clinically presenting with abdominal pain, vomiting, absolute constipation and later on with surgical evidence of intestinal obstruction were included to be part of the study. Exclusion criteria included patients with signs of intestinal obstruction but who were managed non-surgically with conservative techniques. Patients with contra-indication to iodinated or radiation agents were also excluded from the study. This study included 141 patients.

Informed consent was taken from all patients. Ethical committee approval was taken from institutional review board.

Multi-detector CT scan was performed and results were interpreted by 2 radiologists having more than five years of post-fellowship experience.

SPSS v.20 was used for statistical analysis. The age of patient was presented by mean  $\pm$  S.D. Frequency and percentage were calculated for gender and point of transition.

Diagnostic value of MDCT scan was demonstrated. Surgical findings were taken as gold standard. Stratification was done with regard to age and gender to see the effect of these on the outcome. Post-stratification chi-square test was applied. P-value  $\leq 0.05$  was taken as significant.

### OPERATIONAL DEFINITIONS:

**Point of transition:** Presence of air/fluid filled, dilated small bowel loops with diameter more than 2.5 cms was defined as point of transition.

**True positive:** Point of transition correctly depicted by MDCT imaging also is in agreement with the findings at final surgery.

**True negative:** When no point of transition was found on surgery or MDCT Scan

**False positive:** Point of transition wrongly detected on MDCT imaging which is not found at surgery.

**False negative:** Point of transition not detected on MDCT imaging which is found at surgery.

**Sensitivity:** True positive/ (True positive + False negative) X 100

**Specificity:** False positive/ (True negative + False positive) X 100

**Negative predictive value:** True negative/ (True negative + False negative) X 100

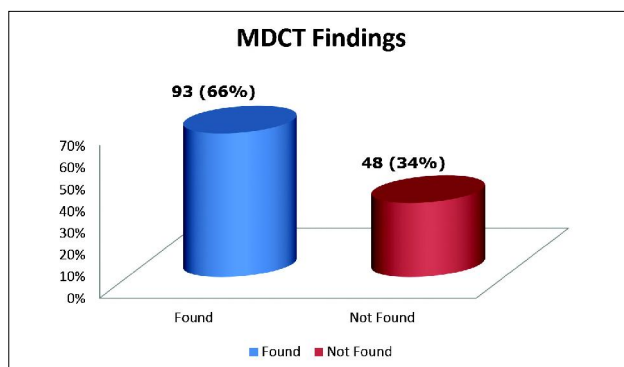
**Positive predictive value:** True positive/ (True positive + False positive) X 100

## Results

The study included 141 patients. Of them 47 were males and 94 were females. Mean age of the patients

was  $46.89 \pm 10.21$  years. Most of the patients presented were of age  $>40$  years. Female preponderance was found.

Surgical findings showed 100 (70.90%) patients with point of transition. MDCT findings showed 93 (66%) patients with point of transition (Fig. 1). Diagnostic Accuracy of MDCT findings taking surgical findings as a gold standard showed sensitivity as 89%, specificity 90.2%, positive predictive value 95% and negative predictive value 77%. Overall diagnostic accuracy was found to be 89% ( $p$ -value $<0.005$ ). (Fig. 1 & Tab. 1-3).



**Figure 1:** MDCT Scan findings of point of transition

**n = 141**

MDCT Finding	Surgical Finding			p-value
	Found	Not Found	Total	
Total	100	41	141	0.001
Found	89	4	93	
Not Found	11	37	48	

Sensitivity =  $(89 \div 100) \times 100 = 89\%$   
 Specificity =  $(37 \div 41) \times 100 = 90.2\%$   
 Positive predictive value =  $(89 \div 93) \times 100 = 95\%$   
 Negative predictive value =  $(37 \div 48) \times 100 = 77\%$

**Table 1:** Comparison of surgical findings with MDCT findings

**n = 54**

MDCT Finding	Surgical Finding			p-value
	Found	Not Found	Total	
Total	39	15	54	0.001
Found	37	3	40	
Not Found	2	12	4	

Sensitivity =  $(37 \div 39) \times 100 = 94\%$   
 Specificity =  $(12 \div 15) \times 100 = 80\%$   
 Positive predictive value =  $(37 \div 40) \times 100 = 92\%$   
 Negative predictive value =  $(12 \div 15) \times 100 = 80\%$

**Table 2:** Age  $\leq 40$  years & comparison of MDCT findings with surgical findings

**n = 87**

MDCT Finding	Surgical Finding			p-value
	Found	Not Found	Total	
Total	61	26	87	0.001
Found	52	1	53	
Not Found	9	25	34	

Sensitivity =  $(52 \div 61) \times 100 = 85\%$   
 Specificity =  $(25 \div 26) \times 100 = 96\%$   
 Positive predictive value =  $(52 \div 53) \times 100 = 98\%$   
 Negative predictive value =  $(25 \div 34) \times 100 = 73\%$

**Table 3:** Age  $>40$  years & comparison of MDCT findings with surgical findings

## Discussion

Patrica et al found that small bowel obstruction accounts for majority of obstructions.<sup>13</sup> Large bowel obstruction accounted for 25-35% of obstructions. Adhesions was the most common cause accounting for small bowel obstruction. Other causes include strangulated hernias, volvulus, benign or metastatic tumors, crohn's disease or ulcerative colitis, gallstone ileus. The main causes for large bowel obstruction were malignancies, sigmoid diverticulitis and volvulus.<sup>14</sup>

When radiological investigations are uncertain regarding the diagnosis of small bowel obstruction, multi-detector CT scan offers certainty in diagnosis.

Scrima et al concluded in his study that findings on MDCT scan are associated with valuable surgical outcomes in patients with small bowel obstruction.<sup>15</sup> Sheikh et al conducts his study analyzing the specificity and sensitivity of multi-detector CT scan. He concludes that MDCT is an excellent modality to evaluate the cause and location of intestinal obstruction as either intramural or extramural along with presence or absence of any complication such as intestinal perforation or ischemic changes. Sheikh et al reports the sensitivity of MDCT in the diagnosis to be 96.3% whereas the specificity was 100%.<sup>16</sup> These results are similar to results of our study which also demonstrates high sensitivity and specificity of MDCT in diagnosis of small bowel obstruction when surgical findings were taken as gold standard. Our study showed sensitivity of 89% and specificity of 90.2%. The overall diagnostic accuracy was found to be 89%. Our results also demonstrated that the sensitivity and specificity is greater in patients with age less than 40 years.

Early diagnosis of small bowel obstruction is associated with adequate management and improved outcome. The identification of the correct cause for obstruction can change the category of incision a surgeon makes.<sup>17</sup> Zaitin et al demonstrated that MDCT scan can also be used for detection of internal hernia or strangulation.<sup>18</sup>

## Conclusion

MDCT helps in determination of 'point of transition' which is a specific notion for surgical management of patients. Other radiologic and laboratory measures are not as useful as MDCT Scan in making the decision whether surgical intervention should take place or not. Good understanding and use of the imaging modalities available for the diagnosis of small bowel obstruction is important for management of patients with bowel obstruction.

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There is no conflict of interest.

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