Discussion:

A total of 270 cases of acute intestinal obstruction were taken up for this study. They all were examined clinically radiologically and further, subjected to laparotomy and had the diagnosis confirmed. Out of 270 cases of acute intestinal obstruction 100 cases were confirmed after laparotomy as cases of volvulus. Patients who were relieved by routine conservative measures were not taken up for study. A study was made of the clinical features, radiological diagnostic methods and their interpretation, etiological factors. A special note was made of incidence of mobile cæcum in every case. The different types of volvulus we encountered were:

1. Sigmoid volvulus.

2. Small bowel volvulus.

3. Cæcum and ascending colon volvulus.

1. Volvulus of the sigmoid colon:

In the present study 30 cases of volvulus of sigmoid colon were encountered out of a total of 270 cases (11.11%) of acute intestinal obstruction operated during June 1968 to August 1969. It further constituted 30% of operated cases of volvulus. 

Brunsgeards (1947)
found volvulus of sigmoid colon to be 30-50% of all cases of intestinal obstruction in East European countries. Henry (1940) found the incidence to be 7% in America. Chaliniski found an incidence of 33% among the Russians. Spassokukoski on the other hand found the incidence to be 69% among the Russians. There is a wide variation in the incidence reported by the British workers. Wilson and Dunwoody (1965) found the incidence to be 4%. Scott (1968) found it to be 65% amongst the Northern Iraqians. Bean and Harvey (1952) reported a 25% incidence in the mental hospital cases. Freuden and Westmann (quoted by Becon) found volvulus in 35% of their patients from Berlin.

In India volvulus of the sigmoid colon has been reported by many authors. The incidence in all studies is less than 10%, as Ranarji (1943) from Eastern India 9.03%, Anderson (1955) 11.08% from Eastern India, Virmani (1963) 5% or less from Delhi, Sankaran (1962) 6.22% from Madurai, Jain and Prasad (1963) 5% or less from Calcutta, Penn and Kuruvilla (1964) 5% from Vellore, Gupta and Vaidya (1969) 9.4% from Varanasi. Recently Gupta (1972) from Kanpur has reported the incidence to be 10%.

Our observation tally with the observation of other Indian workers, that the volvulus of the sigmoid colon is common amongst vegetarians.
AGE AND SEX:

This disease is more common among males than females. In our study 16 were males and 12 females. Gupta (1972) found the incidence to be little higher among the female patients of Kanpur area (45.46%). Patlely (1972) found the incidence higher in males (79%). Foreign Workers like Burton (1959) found the ratio to be 60:40 between males and the females. Ingalls et al. (1964) found the incidence to be 3-4 times more in the males. Recently C.S. Ramachandran (1969) reported 84 cases in females and 19 in males out of 103 cases of sigmoid volvulus (82.35%).

Though the volvulus of the sigmoid colon is common among males yet its incidence in females is significantly high.

Volvulus of sigmoid colon is primarily a condition of the elderly. 70% cases ranged between 41-60 years in the present study. The oldest patient was 79 years old Hindu male. 6 patients were in the 11-30 years age group. The youngest being a 14 years old child. 72.42% of Gupta's cases were between 31-60 years age group. His youngest patient was a 16 years old girl and the oldest an 80 years old male. Drapanas and Stewart (1961) found 86% cases above the age of 55 years.
Botsford et al (1967) reported 13 out of 16 patients above the age of 60 years, the youngest was 18 years old and the oldest was 92 years old. Rataley (1972) reported an average age of 53 years which ranged between 32-65 years. It is obvious that this disease occurs primarily in the elderly age group, but younger age groups are not immune from the volvulus of sigmoid.

RURAL AND URBAN DISTRIBUTION:

73.33% of sigmoid volvulus cases came from the rural areas of Bundelkhand region. 3 patients were Muslims and total 12 patients were nonvegetarians. For all practical purposes an average Indian is a vegetarian. Even the so called nonvegetarian consumes so little of meat that it would be wrong to call them nonvegetarian. In our study a good percentage of cases of sigmoid volvulus were nonvegetarians (40%).

PRESENTING SYMPTOMS:

In our study the common symptoms were absolute constipation (100%), distention of abdomen (100%), pain in abdomen (100%) and vomiting (33.33%). Gupta observed absolute constipation in 100%, pain in abdomen 97.6%, distention of abdomen 98.7%, vomiting in 92.00% of cases. The incidence of vomiting was higher in present study it was probably due to the fact that these cases came comparatively late (4-5 days). In our study 30 cases admitted on second and third day of the onset.
Of their symptoms only 2 patients presented themselves on the very first day of the onset of their symptoms, one patient came on the 9th day.

In 91 cases reported by Brunsgeard (1947) the duration of symptoms before admission to the hospital was 12 to 72 hours. Pateley (1972) observed an average duration of symptoms for 4 days, the shortest duration was 2-3 hours and the longest was 10 days in a 35 years aged man.

**DIAGNOSIS**

Diagnosis of volvulus of sigmoid is usually suggested by history and confirmed by clinical and radiological examination. There were still, however, certain percentage of cases which could be finally diagnosed on the operation table. In our study only 21 cases (70%) were diagnosed clinically, 6 cases (20%) were diagnosed radiologically and the rest 3 cases (10%) were only diagnosed on laparotomy. In these 10% of cases, clinical examination and radiological examination failed to confirm the diagnosis of sigmoid volvulus. Pateley reported that in 65% of cases it was possible to diagnose clinically and in 29 out of 35 cases (82.9%) it was possible to diagnose by flat film of abdomen and only 3 cases were left to undiagnosed either clinically or by
X-ray examination. In Gupta series 68.3% were diagnosed clinically the diagnosis became clear in 95.26% of cases after taking X-ray. 10.39% were undiagnosed and confirmed only at the time of laparotomy.

**SMALL BOWEL VOLVULUS**

In present study 56 cases of small bowel volvulus were encountered out of 270 cases (20.74%) of acute intestinal obstruction. It constituted 56% of all operated volvulus cases.

Epstein and Miller (1950) from Canada have reported a series of 23 cases of small bowel volvulus. Mc Walters (1943) reported a series of 130 cases of volvulus, out of which 36 cases were of small intestine (26%). Vich (1912) found an incidence of 48% in 11 British hospitals. There is a wide variation in the incidence reported by different American workers. Saler and Mc Leathwa reported an incidence of 6% in Americans while Horetz and Morton (1930) found the incidence to be only 0.01% in America.

In India, the incidence of small bowel volvulus is significantly low in comparison with British series, while high in comparison with American series. Ojha (1950) found the incidence to be 16%. Incidence of small bowel volvulus, out of all acute intestinal obstruction cases as reported by other workers is as follows:-
Anderson (1954) 7.3%, Kocher, Nai and Singh (1966) 12%, Rao (1954) 20%, Taneja (1962) 7.7% etc.

The incidence of small bowel volvulus was significantly high in the present series than the sigmoid volvulus. This is well in confirmation with the observation of Samprjic (1950). The incidence of small bowel volvulus and sigmoid volvulus is nearly same in the series reported by Anderson (1956), Kocher, Nai and Singh (1966).

AGE AND SEX

The volvulus of the small bowel is definitely a disease of the younger people mostly 20-40 years of age while volvulus sigmoid is primarily the disease of the older age group usually between 40-60 years of age; though the occurrence once in a while, in either extremes of the ages, are not uncommon. The abdominal muscles are very lax in older age group and this probably could explain the more frequent occurrence of volvulus of sigmoid in them because the volvulus sigmoid requires greater space for rotation. Also the older people are usually sedentary workers and their mesenteric probaly gets lengthened in size over a period of long age.

Volvulus of the small intestine is primarily a condition of young age group. 30 cases out of 56 cases of small bowel volvulus were in the age group of 21-40 years. In our study '3' patients were in the age group
of 61-70 years. The youngest case was a 2 year muslim male child while the oldest patient was a 68 year Hindu male.

Peak incidence in Penn and Kuruvilla's cases was in the age group 20-40 years. The case was reported by Ojha (1950), Babcock and Wayne, Anderson (1957) reported that average age for small bowel volvulus was 30 years. In Banarjee's series the maximum incidence was seen between the age group of 21-30 years. Moretz and Morton (1950) reported 30 cases of small bowel volvulus ranging between age groups of 2 days to 80 years, but the maximum incidence was encountered between 20-40 years (50%).

It is obvious that this disease occurs primarily in the age group 20-40 years but elderly age group are not immune from small bowel volvulus.

Small bowel volvulus is more common in males than females. In the present study 36 cases (64.38%) were males and 20 cases (35.72%) were females. Ojha (1950) reported 10 cases of small bowel volvulus all of which were females. Babcock and Wayne (1946) also found the incidence to be a little higher in females (34%). Penn and Kuruvilla (1964) found the ratio to be 29:2 between males and females. Anderson (1957) found the ratio to be 12:2 between males and females. Banarjee reported the ratio to be 21:1 between males and females. Volvulus of
the small bowel is primarily a disease of the males like volvulus of the sigmoid, but the females are also liable to be involved to a significant degree. There is wide variation in the incidence and ratio of the prevalence of the disease in the two sexes. The Indian males and females, especially from the villages are heavy manual workers. This can explain the higher incidence of volvulus of small bowel in heavy workers than in sedentary workers.

RURAL AND URBAN DISTRIBUTION:

In the present study 29 patients (57.89%) were from rural population and 16 patients (32.31%) were from urban area. The patients from rural area were all heavy manual workers, and they developed volvulus within 4-5 hours usually after taking meals. The volvulus invariably occurred while they were engaged in active work in the fields. This supports the view expressed by Ojha (1950) and Kirkaldy (1946).

The occurrence in villages, their dietary habits i.e., taking meals only twice a day with fast in between, taking a heavy meal followed by immediate exertion without proper rest, tend to support the views of Ojha (1950).

PRESENTING SYMPTOMS:

In our study the common presenting symptoms were pain in abdomen and vomiting (89.38%). Constipation
(71.42%), distention (62.50%). Horvitz and Morton (1950) observed that pain in abdomen and vomiting were the prominent features, while constipation was present in 45% cases. Distention was present in 70% cases. In Kochma and Priestley series (1939) pain was present in 65.7%, nausea and vomiting in 74%, constipation in 51.4%, distention in only 11.4%. In Leonard and Berow's series (1932) pain and vomiting were present in 100%, constipation in 30%, and distention in 50%.

In volvulus of the small bowel, the cardinal features were pain and vomiting while in volvulus sigmoid the cardinal symptoms were distention of abdomen and absolute constipation.

42 out of 56 (73.94%) cases came to the hospital with in 3 days of onset of their symptoms. While 11 patient came on the fourth and fifth day. Only two patients came on the seventh day of the onset of their symptoms.

The patients of volvulus of small bowel came to hospital a little earlier than the volvulus of sigmoid. This was due to the fact that severe attacks of pain in abdomen and vomiting were more debilitating symptoms than the absolute constipation and distention of sigmoid volvulus.
DIAGNOSIS

In most of the cases it is easy to make the diagnosis as small intestinal obstruction, but difficult to make a diagnosis of volvulus of small intestine. In the present study only 25 cases out of 56 cases of small bowel volvulus were diagnosis clinically. In 22 cases diagnosis of small bowel volvulus was supported by X-ray examination and confirmed by laparotomy. While a cases could not be diagnosed by either clinical or radiological means and were only confirmed enter on by laparotomy.

Moreschi and Morton (1930) could not make any diagnosis in 8 cases out of 36 cases of small bowel volvulus. Of the remaining 25 cases the diagnosis of small bowel obstruction was made in 17 cases (47.2%). The diagnosis of small bowel volvulus was made correctly in 7 cases. Kechar, Kai and Singh (1966) have mentioned that it is not possible to make a specific diagnosis of the cause and type of small bowel obstruction. Similarly Penn and Kuruvilla (1964) have reported that X-ray is always successful in confirming the diagnosis of small intestinal obstruction, but made a diagnosis of volvulus in only half.

In our study 22 cases out of 56 patients presented themselves within 2 days of starting of their symptoms. Out of these 22 cases only 6 could be diagnosed clinically as
small bowel volvulus. The classical ladder pattern and visible peristalsis, tend to be seen visibly after 24 hours, but very clearly after 48 hours. This probably explains the difficulties in diagnosing a case of small bowel volvulus in the earlier period.

3. CASCAL VOLVULUS:

In the present study 14 cases of volvulus of cecum and ascending colon were encountered out of a total of 270 cases of acute intestinal obstruction operated during the above period. It constituted 14% of all operated volvulus cases.

Its incidence, as recorded in the literature, is less than 1% of all acute intestinal obstruction. Rai, Kocher (1970) reported the incidence to be 1.3%.

The incidence of cecal volvulus is less than that of small bowel volvulus and sigmoid volvulus. But it is not as rare as is commonly believed. The low occurrence of cecal volvulus is due to the fact that cecum is retroperitoneal fixed structure with no meso cecum. The volvulus occurred only in cases who had a mobile cecum with a fair degree of meso cecum.

AGE AND SEX DISTRIBUTION:

The disease is said to be more common among males than in females. In present study 8 (57.14%) cases were
males and 6 (42.87%) cases were females. Wilson (1965) found the incidence to be higher among females (55%). In Kocher and Sal series (1979) all patients were males. In Winslow and Carter's series (1958) ratio between males and females was equal. The same was reported by Saint (1958). In Mc Crow, Kremen and Rigler series (1956) all the patients were males.

In our study 8 cases (57.14%) ranged between 21-40 years of age. The oldest patient was 55 years of age while the youngest was a 13 year old child. Saint (1958) has reported that this disease is found between the ages of 20-40 years. In the series reported by Faltin (1961) 45% were between the ages of 16 and 30 years. The youngest patient reported was an infant 12 months old, and the oldest patient was a man of 59 years of age. In Jordan and Jahrs (1953) series an incidence of 70% was found under the age of 40 years. In Mc Crow, Kremen and Rigler (1956) series all the four patients were above 50 years of age.

In Indian patients volvulus cecum and ascending colon is predominantly the disease of the males though females do suffer from it, once in a while. On the other hand, in Western literature, the incidence among females is much higher. This probably supports the view that volvulus occurs among heavy workers like small bowel volvulus. This is further supported by the fact that, though cecum is the part of the large bowel, yet its incidence is common in the same age group (20-40 years).
as occur in small bowel volvulus.

RURAL AND URBAN DISTRIBUTION

57.15% cases of cecum and ascending colon volvulus came from rural population. All the cases were Hindus and vegetarians.

Like volvulus of small bowel and sigmoid colon, cecal volvulus nearly always occurs the village folk and vegetarians. This is probably due to the fact that the same factors are responsible for production of volvulus of small bowel, sigmoid colon, and cecum.

PRESENTING SYMPTOMS

In the present study, the main clinical features were pain in abdomen 100%, vomiting 100%, and constipation 71.42%. Distention was present in 52.50% of cases. Kinshaw and Carter (1959) divided the cecal volvulus into two groups, according to the clinical presentation. One is acute fulminating type, and the other is acute obstructive type. The main complaint of patients in Kochar and Nai's series (1970) were, pain in abdomen, vomiting, constipation and distention. 57.15% of our cases came to hospital within 3 days of their onset of symptoms. Only one patient came on the seventh day. In Kochar and Nai's series all the patients presented themselves on the 3rd and 4th day. In Kinshaw and Carter series 26% presented themselves on the first day of the onset of symptoms.
Weiner (1956) reported that from a clinical point of view the only diagnosis that can be made in a case of acute caecal volvulus is intestinal obstruction.

**DIAGNOSIS:**

Patients with volvulus caecum presented clinically with symptoms and signs of small bowel obstruction. The cardinal symptoms being pain in abdomen and vomiting. Volvulus of the small bowel also presented with similar symptoms. This clinical presentation can be explained by the fact, that there is obstruction also ileocaecal junction due to volvulus of cecum. The other group of signs which were observed due to volvulus of cecum, were in addition to the common signs of small bowel obstruction and these consisted of greater distension in the right flanks, and fullness in the right iliac fossa due to distended cecum inside. But more than 50% cases could be diagnosed only on laparotomy.

The only positive manner of arriving at a correct diagnosis is, by careful x-ray studies, in our study only one case diagnosed clinically (7.14%) 4 were diagnosed radiologically (28.57%) 9 cases (69.29%) could be diagnosed only after laparotomy.

Chalfant (quoted from Weisenerstein 1942) stated that unusual mobility of cecum and ascending colon were present in 30% of persons of all ages, but the incidence of volvulus
cæcum is correspondingly and comparatively low. It is
due to the fact that the thickness of the mesocæcum i.e.
the distance between the two layers of peritoneum of the
mesocæcum, was quite big 1" - 2". This hindered,
mechanically, with the occurrence of volvulus cæcum
unless the mesocæcum was so long as to under go the
twist. In our series the depth of meso cæcum was so
long that the cæcum presented freely outside the
abdominal wounds after untwisting.

While in cases of the volvulus of the small bowel
and the sigmoid colon, preoperative diagnosis could be
made in majority of the patients. In volvulus cæcum,
diagnosis was confirmed on laparotomy in a significant
number of cases (68.20%).

The twist was anticlock wise in 11 cases (78.57%)
and in 3 cases it was clockwise twist. Mesocæcum was
present in all the cases of cæcum and ascending colon
and the cæcum was freely mobile.