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COMPARISON BETWEEN SONOGRAPHIC AND PLAIN RADIOGRAPHY IN THE DIAGNOSIS OF SMALL BOWEL OBSTRUCTION AT MULAGO HOSPITAL, UGANDA
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COMPARISON BETWEEN SONOGRAPHIC AND PLAIN RADIOGRAPHY IN THE DIAGNOSIS OF SMALL BOWEL OBSTRUCTION AT MULAGO HOSPITAL, UGANDA

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ABSTRACT

Objective: **To evaluate the role of sonography compared to plain radiography in the diagnosis of patients with suspected small bowel obstruction as well as to determine their specificity, sensitivity and accuracy in the Ugandan setting.**

Design: **Prospective comparative study.**

Setting: **Mulago Hospital, Uganda's main referal Hospital and Makerere University Medical School.**

Subjects: **Seventy patients with suspected small bowel obstruction (SBO) were evaluated at Mulago Hospital between December 1998 and January 2000, 42 patients were males and 28 females. Patients were aged three days to two years and had a clinical suspicion of SBO.**

Results: **Of the 70 patients, 55 were confirmed to have had SBO. Four had ileus and 11 had no SBO. Sixty four per cent were managed surgically while 36% were managed conservatively. Sonography made a diagnosis of SBO in 92.7% and detected strangulation in 71% of patients. Plain radiography made a diagnosis in 85.5% of patients and did not detect strangulation. Specificity was 100% for both, sensitivity 93%, PPV 100%, NPV 73% for sonography. Sensitivity was 85%, PPV 100%, NPV 58% for plain radiography.**

Main outcome measures: **The accuracy of sonography was 93% as compared to 87% for plain radiography. The level of obstruction was correctly predicted in 81% by sonography and 64% with plain radiography.**

Conclusion: **It was concluded that sonography is as accurate, specific and sensitive as plain radiography in the diagnosis of SBO as well as determining the level of obstruction in a Ugandan setting. Sonography was found to be more accurate at determining the cause of obstruction and detecting strangulation. It is recommended that sonography should be the initial imaging modality for patients presenting with suspected SBO and plain radiography should only be used as a complimentary investigation.**

INTRODUCTlON

Small bowel obstruction (SBO) is one of the surgical emergencies that require accurate and prompt diagnosis. At Mulago Hospital, SBO accounts for 40% of all the cases of intestinal obstruction, which in turn account for 20-30% of the total annual surgical emergencies (Mulago Hospital register). Common causes of SBO in Uganda differ from those documented in other parts of the world as established from the Mulago hospital register. In Uganda, external hernias form a significant portion of the cases followed by adhesions, in the Western world adhesions followed by neoplasms rank highest (1,2).

At Mulago Hospital, plain radiography is commonly used in evaluating patients suspected to have SBO. Sonography has not been popularly used in evaluating these patients. When clinical assessment points to SBO, a clinician often relies on imaging modalities to further evaluate the patient. Therefore a modality, which accurately and promptly arrives at a diagnosis while preserving the patient's safety and comfort, would be most appropriate. For a long time plain radiography has been used as the initial imaging modality in the evaluation of SBO(1,2). Plain radiography is sometimes inconclusive or equivocal and rarely detects the cause of obstruction(3). At the same time it cannot assess the presence of strangulation.

Ultrasound has become a popular clinical imaging procedure worldwide(4). Literature suggests that sonography is complimentary to plain radiography in evaluating SBO(6-9). No comparative data is available for the two imaging modalities at Mulago Hospital; this study attempted to define their value in the diagnosis of SBO at Mulago Hospital.

MATERIALS AND METHODS

A prospective comparative study was carried out at Mulago Hospital between December, 1998 and September, 1999. Seventy patients (42 males, 28 females) aged three days to 72 years (mean age 33 years) with a clinical diagnosis of SBO were evaluated using plain radiography and abdominal sonography in the Department of Radiology, Mulago Hospital. The patients selection depended on presence of symptoms compatible with mechanical SBO. These included acute abdominal pain, abdominal distension, vomiting and constipation. The sonographic examination was done prior to plain radiography to avoid bias. The senior house officer under the supervision of a senior radiologist using the available sonoline prima or sonoline SL-l-ultrasound machines performed all the sonographic examinations. Using either 3.5, 5.0 or 7.5 mHz curved or linear array probes. A 7.5 MHz probe is especially useful in very thin patients and children. Sonography was performed with the patients in supine and lateral positions, preferably with a full urinary bladder. All the areas of the abdominal cavity and pelvis were examined using graded compression technique. When the abdomen was "gassy" emphasis was put on the flanks.

At sonography, differentiation of the dilated colon and small bowel loops depended on location and course for the bowel loop as well as absence or presence of vulvulae conniventes for small bowel and haustra for colon. Dilated jejunal and ileal loops were distinguished by analysing the pattern (height and frequency) of the vulvulae conniventes. The loop with high and frequent vulvulae conniventes was considered jejunal and when sparse and low or absent, it was considered ileal.

Mechanical SBO was considered present at sonography, whenever the lumen diameter was greater than 25mm for the jejunum and 15mm for the ileum over a length of more than 100mm or more than three loops together(1,2). Important sonographic signs like increased intraluminal contents (fluid and echoes), increased or pendulous peristalsis of the dilated segment shown by rapid progression or pendulous motion of the bowel contents and collapsed distal segment were considered. The level of obstruction was determined by the location of dilated bowel loops and pattern of vulvulae conniventes at the distally dilated loops as described by Ko (1). Where an obvious abnormality coincided with the transition point e.g. an (abscess, cyst or intussusception) it was considered the cause of obstruction(1). Where no apparent cause at the transitional zone was seen; peritoneal fibrous adhesions were considered the cause of obstruction. This is referred to as the sonographic criteria for adhesion. Sonographic signs of strangulation and gangrene like localised and generalised ascites, aperistaltic loops, air in portal vein and intra luminal fluid-fluid levels were also assessed.

Paralytic ileus was considered present when signs like dilated aperistaltic SB loops with abundant gas and dilated colon filled with gas, fluid or stool were noted. Sonographic results were analysed on basis of the initial report at the time of examination. Hard copy sonograms were made for record. Two senior radiologists did the image interpretation. The major draw back with the use of ultrasound is that it is operator dependant. This may be a cause of error, that's why two radiologists worked with the senior house officer to overcome this.

After sonography supine and erect plain abdominal X-rays were done on all patients. The lateral decubitus film was not done because of financial constraints. The radiological findings, clinical and laboratory data were entered into a data sheet. The clinical final diagnosis at discharge was considered the standard of reference. This was obtained at surgery, histology or by the patient clinical course. This was established at surgery in 35 patients and by clinical evaluation in 35 patients.

RESULTS

Seventy patients from different parts of Uganda were evaluated. The age range was three days to 72 years (mean age 33 years), 40% were females, 60% were males (Figure 1). Fifty five patients were confirmed to have mechanical SBO. Four had ileus while eleven had no SBO. Of the 55 patients, 35(64%) were managed surgically, 20 (36%) were managed conservatively. All the 55 patients, who had mechanical SBO had pendulous type of peristalsis and intraluminal fluid with echoes. Jejunal diameter ranged between 25-40mm while ileal diameters ranged between 15mm-25mm. Sonography made a diagnosis of SBO in 51 patients (92.7%) while it predicted the level of obstruction in 29 of surgically proven 35 cases (83%). The cause was detected sonographically in 20 out of 55 cases (36%) (Tables 1 and 2). When the sonographic criterion for adhesions was used this increased to 44 out of 55 cases (80%). Sonography detected seven of the nine patients with strangulation (77%). All these seven were proved surgically and all had intraluminal fluid-fluid levels at sonography. None of these patients were detected by plain radiography.

Table 1

Results of sonographic examination for small bowel obstruction

Causes of obstruction	No. of cases	Obstruction diagnosed	Cause detected
Adhesions	24	24	0
External hernia	18	14	14
Appendicular mass	2	2	2
Appendicular abscesses	1	1	1
Ovarian cyst	2	2	2
SB Volvulus	1	1	0
Internal hernia	2	2	0
Ileal atresia	2	2	0
Ilio-sigmoid knotting	2	2	0
Intussusception	1	1	1
Total	55	51	20

Plain radiographic examination made a diagnosis in 47 patients (85.5%). The cause of obstruction was only detected in six cases (11%).

Table 2

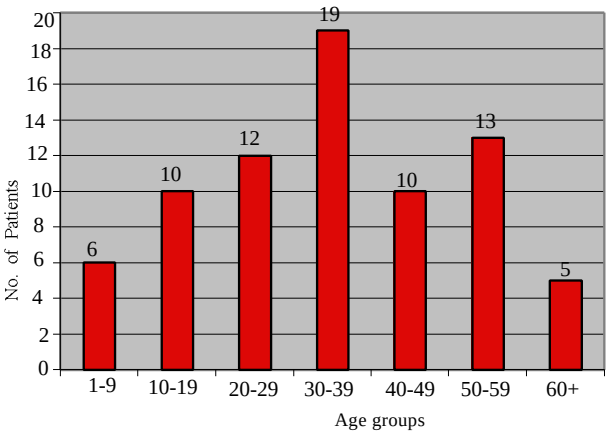
Results of radiography examination for small bowel obstruction

Causes of obstruction	No. of Cases	Obstruction diagnosed	Cause detected
Adhesions	24	23	0
External hernia	18	11	6
Appendicular mass	2	2	0
Appendicular abscess	1	1	0
Ovarian cyst	2	2	0
SB volvulus	1	1	0
Internal hernia	2	2	0
Ileal atresia	2	2	0
Ilio sigmoid knotting	2	2	0
Intussusception	1	1	0
Total	55	47	6

Specificity was 100% for both, sensitivity 93%, PPV 100%, NPV 73% for sonography. Sensitivity was 85%, PPV 100%, NPV 58% for plain radiography. Statistical analysis using the chi square test showed that there was no significant difference between the results of the two diagnostic modalities in making a diagnosis of SBO and determining the level of obstruction (P> 0.5) at 5% level of confidence limits. There was significant difference between sonography and plain radiography (P > 0.05) at 5% level of confidence at detection of the cause of SBO.

Figure 1

Patients distribution by age



Patients less than one year are included in the 1-9 group.

Figure 2a

Longitudinal scan through the lower quadrant demonstrates a dilated S0B loop (ileum) and a thick walled cystic mass posterior to the urinary bladder with internal echoes. The distally dilated ileum tapers off at the level of the mass

Figure 2b

Transverse scan. The thick walled round cystic mass is noted in the recto vesicle pouch

Sonographic examination using a 5.0 MHz curved array probe

Figure 2c

Plain abdominal film demonstrates non-specific gaseous shadows with no dilated SB loops

Images of a 36-year-old male who was lame since childhood and had scoliosis because of the lower limb deformity. He was referred with features suggestive of intestinal obstruction. He had been treated conservatively for appendicitis. Sonographic examination using a 5.0 MHz curved array probe was done.

Figure 3a

Longitudinal scan through the right iliac region demonstrates an echo complex mass at the transitional point of the distally dilated ileal loop. The level of obstruction is at the ileum

Figure 3b

Longitudinal scan demonstrates multiple dilated jejunal loops with increased intra luminal fluid and echoes. This was an appendicular mass

Figure 3c

Supine film reveals multiple gaseous dilated SB loops

Figure 3d

Erect film shows multiple SB air-fluid levels on the right with no obvious mass seen

The images of a 35-year old female with history of salpingoophrectomy six months ago

Figure 4a

Longitudinal scan of the abdomen depicts multiple fluid-filled dilated ileal loops with intra luminal echoes and a little inter loop fluid collection. No cause detected

Figure 4b

Transverse and oblique scans through the lower quadrant reveals intraluminal fluid-fluid levels

Figure 4c

Erect film demonstrates multiple air fluid levels with a "string of beads" sign. No sign of strangulation

Plain radiographs of abdomen reveal scoliosis with concavity to the right.

Figure 4d

Supine film demonstrates gaseous dilated jejunal loops with no signs of strangulation

Plain radiograph of the abdomen.

DISCUSSION

The usefulness of sonography in the evaluation of SBO has been documented in a few previous studies(1,2,5). In Mulago Hospital, plain radiography is widely used for investigating patients with suspected SBO. This is because it is the examination that is widely accepted by the doctors. Plain radiography has been used for along time and has been found to be fairly accurate. No studies showing the advantages of ultrasound had been done before in Mulago Hospital so there was no need for change. In this study, we were able to establish that sonography, which has not been popularly used in evaluating SBO at Mulago Hospital is as useful as plain radiography in confirming the diagnosis and defining the level of obstruction as well as identifying the complication of strangulation. We feel that these results apply to Uganda as a whole because the patients studied were from different regions of the country, of both sexes and of varying ages. There was no statistical difference between the specificity, sensitivity and accuracy of both imaging techniques. This is similar to what has been reported in previous studies. These findings are significant in the developing world because sonography is cheap, portable and does not use ionising radiation. This is particularly significant for Mulago Hospital as trained manpower and ultrasound equipment is now available. The patients with suspected SBO are usually, very sick and so need quick and portable means of investigation like ultrasound. Schmutz *et al*(1), had earlier reported that a gassy abdomen was a significant set-back in evaluation of patients with SBO, however this was not the case in the study. A gassy abdomen was only encountered in one patient. This could be because of the differences in diet between the populations.

The commonest cause of SBO in our study were adhesions 44% and external hernias 33% compared to 22% adhesions and neoplasms 24% in Western studies as in Schmutz *et al* report(1). In Japan adhesions account for 64% of the causes of SBO(5). Adhesions are common causes of SBO in Uganda and can be indirectly diagnosed using sonography whereas this is not possible with plain radiography. There is an increase in adhesions as a cause of SBO in Uganda as earlier reported by S. Wandira who did work on intestinal obstruction at Mulago Hospital in 1997 (unpublished). The number of external hernias is falling possibly because of increased awareness amongst the population as well as improved surgical facilities. The improved surgical facilities further explain the increase in surgery, which would explain the increase in adhesions. All the cases with adhesions had a previous surgery. Inguinal hernias were the major external hernias in this study. This has not been the case in Western world studies. Why they are common in our series and not in the Western world remains to be studied.

Adhesions formed a large proportion of the aetiologies in the Ko *et al*(2) study but he did not use the sonographic criteria for diagnosis of adhesions so the value of detected aetiologies was low. Four patients in the study detected to have adhesions using the sonographic criteria were proved to have SBO due to adhesion surgically because they had strangulation. Although the number in this study is small, we feel that this criterion is useful. Complicated SBO (Strangulation) was found in nine patients at surgery. This is high compared to only one patient in Ko *et al.* series (2). This possibly results from a delay in reporting to hospital and is easily explained by low social economic status, limited hospital facilities, poor means of transport and lower doctor patient ratio in the developing countries.

Sonography was found to be better than plain radiograph at establishing the diagnosis of SBO and differentiating between paralytic ileus and mechanical obstruction. In conclusion, sonography where expertise and equipment is available should be the initial investigation in patients presenting with SBO and that plain radiography should only be used as a complementary tool.

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