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Oral Urografin in Postoperative Small Bowel Obstruction

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Abstract. The aim of our study was to determine whether Urografin has the potential to offer surgeons a way of differentiating complete from partial small bowel obstruction and whether partial small bowel obstruction can be treated nonoperatively. Altogether 116 patients who had postoperative small bowel obstructions without any toxic signs underwent Urografin studies. Urografin (40 ml) mixed with 40 ml of distilled water was administrated either orally or via nasogastric tube to each patient. Serial plain abdominal radiographs were taken 2, 4, and 8 hours later. A total of 74 patients (63.8%) whose contrast medium reached the colon within the first 8 hours were considered to have partial obstruction and were successfully treated with intravenous hydration and nasogastric decompression. The remaining 42 patients (36.2%) in whom the contrast medium failed to reach the colon within the first 8 hours were regarded as having complete obstruction, and 34 of those patients (81.0%) underwent surgery; 8 (19.0%) received conservative treatment. Adhesion bands with complete bowel obstruction were observed in all 34 patients (100.0%) during laparotomy. Regardless of the presence of an air-fluid level on a plain abdominal radiograph or abdominal pain, a liquid diet followed by a soft diet could be given to those patients whose Urografin emptied into the colon. All the patients with partial bowel obstruction were treated successfully with nonoperative methods. The presence of Urografin in the colon within 8 hours of ingestion as an indicator for nonoperative treatment had a sensitivity of 90.2%, a specificity of 100%, and an accuracy of 93.1%. Urografin, a safe and reliable water-soluble contrast medium, can be used to differentiate partial intestinal obstruction from complete intestinal obstruction. Early oral intake was found to be a major advantage of Urografin use in this study, and the potential of Urografin use to shorten the period of conservative treatment for postoperative small bowel obstruction needs further investigation.

Postoperative adhesion ileus is thought to be the most common cause of small bowel obstruction in adults [1–4], yet considerable controversy exists concerning its management. To prevent the risk of strangulation or other forms of bowel injury, some authors suggest surgery for any patient with complete intestinal obstruction and reserve conservative treatments for patients with partial obstruction [5, 6]. Complete intestinal obstruction is usually defined by the complete lack of stool or flatus passage and the absence of bowel gas distal to the site of obstruction on a plain abdominal radiograph, but this definition is impractical [7, 8]. It has been reported that significant complications have occurred when operations have been delayed more than 48 hours in patients with adhesion ileus [9]. However, those complications from delayed operations can be prevented if we can find a reliable indicator for early identification of complete obstruction or partial bowel obstruction. To our knowledge, only one published report [10] addressing the use of Urografin (0.1 g sodium diatrizoate and 0.66 g meglumine diatrizoate/ml; Schering AG, Germany) in cases of small bowel obstruction. In this prospective study, we tested the validity of Urografin emptying into the colon as an indicator of partial intestinal obstruction and for giving conservative treatment to patients with partial intestinal obstruction. Examination of this kind of test may help us resume early oral intake in patients with Urografin reaching the colon and thus may shorten the period of conservative treatment.

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Materials and Methods

All patients admitted with postoperative intestinal obstruction to the Departments of Emergency Medicine and Surgery, National Taiwan University Hospital, from August 1, 1994 through June 31, 1996 were included in this prospective study. Each patient's small bowel obstruction was diagnosed based on a clinical picture of abdominal pain, distension, vomiting, and abnormal bowel sounds and was confirmed by seeing the dilated loops of small bowel and air-fluid levels on a plain abdominal radiograph. Patients with cancer peritonitis, signs and symptoms of peritonitis, an age younger than 15 years, or intestinal obstruction occurring less than 30 days following abdominal surgery were excluded. The study included 116 patients, of whom 60 were men and 56 were women. The patients ranged in age from 22 to 81 years, with a mean age of 56.1 years. The duration from previous surgery to this admission ranged from 1 month to 36 years, with a median duration of 5 years, 5 months.

When patients arrived at the Department of Emergency Medicine, they were evaluated by a member of the surgical housestaff, usually a physician at the mid-resident level. After taking a detailed history and performing a physical examination, an erect plain abdominal radiograph was obtained for each patient. If a small bowel obstruction was diagnosed, intravenous hydration with Ringer's lactate solution and gastric decompression with a nasogastric tube was initiated. Urografin (40 ml) mixed with 40 ml

Table 1. Characteristics of 116 patients with postoperative small bowel obstruction.

Mean age in years (range)	56.1 (22–81)
Sex (male/female)	60/56
Patients with symptoms (no.)	
Abdominal pain	102 (87.9%)
Constipation	90 (77.6%)
Vomiting	51 (44.0%)
Median postoperative interval to onset of ileus	5 years, 5 months

Table 2. Previous abdominal surgeries.

Types of surgical procedures	No. of patients
Subtotal gastrectomy	24
Colectomy	18
Appendectomy	17
Truncal vagotomy + pyloroplasty	14
Cholecystectomy	8
Salpingectomy	7
Abdominal total hysterectomy with bilateral salpingo-oophorectomy	7
Highly selective vagotomy	5
Abdominal total hysterectomy	5
Hepatectomy	4
Tubal ligation	3
Cesarean section	2
Myomectomy	2
Total	116

of distilled water was administrated orally or via nasogastric tube to each patient. Serial plain abdominal radiographs were obtained 2, 4, and 8 hours later. If a plain radiograph showed the contrast medium reaching the right side of the colon, further plain abdominal radiographs were not taken.

Despite the presence of an air-fluid level on their plain abdominal radiographs, patients whose plain films demonstrated contrast medium in the ascending colon within 8 hours after Urografin ingestion were given oral magnesium oxide and cisapride, followed by a liquid diet and then a soft diet. The other patients who showed failure of the Urografin to empty into the colon within 8 hours underwent surgery or received nonoperative treatment based on the presence or absence of any toxic signs, including fever, intractable pain, leukocytosis, and peritonitis. The following data were collected for each patient: age, sex, type of previous operation, duration from the operation to the time of the study, and the outcome of treatment. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value were calculated to evaluate the efficiency of the Urografin study.

Results

Altogether 116 patients required admission for intestinal obstruction after abdominal surgery. The characteristics of the 116 patients are shown in Table 1. Most patients presented with abdominal pain and constipation. Vomiting was noted in fewer than 50% of the patients. The types of previous abdominal surgery are shown in Table 2; 73 patients (62.9%) underwent subtotal gastrectomy, colectomy, appendectomy, or truncal vagotomy plus pyloroplasty.

The results of the Urografin study are shown in Table 3. The numbers of patients whose plain radiographs showed Urografin reaching the colon within 2, 4, and 8 hours were 15, 36, and 23, respectively. The obstructions of all of these 74 patients were resolved 4 to 28 hours after their Urografin studies. Although six patients complained of abdominal pain after oral intake, their symptoms subsided after ambulation. Of the 42 patients who failed to show the contrast medium in the colon within 8 hours, 8 (19.0%) were finally discharged 66 to 121 hours after conservative treatment, and 34 (81.0%) underwent surgery. A total of 82 patients (71%) were successfully treated with the nonoperative method. The presence of contrast medium in the colon within 8 hours of ingestion as an indicator for nonoperative treatment had a sensitivity of 90.2%, specificity 100%, accuracy 93.1%, positive predictive value 100%, and negative predictive value 81.0%. Of 34 patients undergoing surgery, 20 had a peritoneal sign, 8 had intractable pain, 4 had fever, and 2 had leukocytosis. These 34 patients were operated on 4 to 24 hours following the Urografin study. Proximal bowel dilation combined with distal bowel collapse and adhesion bands were found in 34 patients (100%) during laparotomy. Neither mortality nor morbidity (including shock, fluid, and electrolyte imbalance, allergy, or aspiration pneumonia) was noted.

Table 3. Results of Urografin studies.

Parameter	No. of patients	Nonoperative treatment (no.)	Surgical treatment (no.)
Time from ingestion to urografin reaching colon			
≤2 hours	15	15	0
>2 and ≤4 hours	36	36	0
>4 hours	23	23	0
Urografin did not reach colon within 8 hours of ingestion	42	8	34
Total	116	82	34

Urografin reaching colon within 8 hours as an indicator for nonoperative treatment: sensitivity 90.2%, specificity 100.0%, accuracy 93.1%, positive predictive value 100%, negative predictive value 81.0%.

Discussion

The most frequent cause of acute small bowel obstruction is postoperative adhesion [1–4]. Numerous attempts have been made to prevent postoperative adhesion, but as yet no method has proven completely effective [11, 12]. The etiology of adhesion formation is not well understood. Numerous factors have been reported to cause fibrinous adhesions [11, 13, 14].

The successful response to nonoperative treatment in patients with postoperative adhesion ileus is reported to be 73% to 90% [5, 7, 15]. Our success rate of 71% with conservative treatment for intestinal obstruction in this study was similar to rates in previous reports. Controversy still exists regarding a reasonable period of time for conservative treatment before resorting to surgical intervention in patients with ileus. It has been reported that nonoperative management of up to 5 days' duration can be used safely for most patients with postoperative adhesion ileus [7], although some reports suggest a shorter period of 12, 24, or 48 to 72 hours [1, 3, 8, 16, 17]. Thus a simple, safe, reliable method for determining an acceptable period of conservative treatment in patients with ileus is necessary.

Barium has been used to conduct upper gastrointestinal studies and to evaluate small bowel obstructions. Barium is preferred to water-soluble contrast media, as barium is less diluted by enteric fluid, has no peristaltic effect on the bowel, and provides detail of the mucosal pattern [5, 18]. However, a barium study can be dangerous in cases of nearly complete obstruction when the barium becomes inspissated above the level of the obstruction or spreads into the peritoneal cavity if perforation occurs [19]. The primary goal of this study was to differentiate partial bowel obstruction from complete bowel obstruction; therefore the mucosal pattern of bowel was not an important factor. Because a water-soluble contrast medium does not involve a large shift of fluid or the risk of barium peritonitis, we chose it rather than barium for evaluating ileus.

Water-soluble contrast media also have been used to evaluate the postoperative adhesion ileus; unlike barium, they are nontoxic when accidentally spread into the peritoneal cavity. A water-soluble, high-osmolar contrast medium can accelerate the resolution of postoperative ileus and enhance the resolution of adhesive bowel obstruction [20, 21]. One recent report, however, showed that water-soluble contrast media have no therapeutic effect on postoperative small bowel obstruction [22]. It has been reported that a low dose of oral Gastrografin (meglumine diatrizoate) causes intestinal hurry with rapid passage of food contents through the bowel [21]. The possible mechanisms causing this action include the high osmolarity of Gastrografin, the dilution of bowel contents and the hydrophilic effect, decreased bowel-wall edema, and enhanced bowel peristalsis [20, 21].

Urografin is a high-osmolar, water-soluble contrast medium for intravenous and retrograde urography and angiography. It has been previously used to evaluate the bowel loop, so we tried to determine the value of Urografin in postoperative small bowel obstruction. The osmolarity of Urografin is approximately seven times that of intravascular plasma. This high osmolarity can draw significant amounts of fluid from both the intravascular space and the extracellular space into the gastrointestinal lumen. The degree of fluid shift is dependent on the osmolarity and volume of the contrast medium. We used only 40 ml of Urografin, and no fluid and electrolyte imbalance or shock was found in this study.

A recent Urografin study recommended that surgical intervention be performed if the contrast medium fails to reach the cecum within 4 hours of ingestion [10]. We have a different opinion. Even though the presence of contrast medium in the colon within 8 hours as an indicator for nonoperative treatment had high sensitivity (90.2%), specificity (100%), accuracy (93.1%), and positive predictive value (100%), we do not recommend the failure of contrast medium to appear in the colon on radiographs within 8 hours to be an indicator for surgery. Our results showed that eight patients (19.0%) in whom the contrast medium failed to show in the colon within 8 hours were successfully treated by nonoperative methods. For patients whose contrast medium failed to empty into the colon within 8 hours, conservative treatment still could be continued if their signs and symptoms improved and no toxic signs were found. Surgical intervention was performed in patients showing toxic signs or if a patient's condition worsened during nonoperative management. One drawback of this study was that we obtained plain abdominal radiographs only up to 8 hours after Urografin ingestion. To predict the patients who need surgical intervention, a radiograph obtained later than 8 hours after ingestion is warranted. Because Urografin is diluted in the gastrointestinal tract over a period of time and then does not appear on a plain radiograph, the exact time to obtain the last plain film needs further evaluation.

Usually oral intake is resumed when the intestinal obstruction has resolved during a period of conservative treatment. Our results showed that oral intake could be started in patients whose contrast medium reached the colon within 8 hours regardless of whether the signs and symptoms of obstruction persisted. Although six patients complained of abdominal pain after oral intake, their symptoms subsided during the period of continued oral intake. Postprandial ambulation is a good method for eliminating this abdominal pain. To determine the value of early oral intake in shortening the period of conservative treatment, a prospective study is necessary.

Conclusions

Urografin, a water-soluble contrast medium, can be used to differentiate partial from complete bowel obstruction. Partial bowel obstruction can be treated with nonoperative methods. Early oral intake can be initiated in patients whose contrast medium reaches the colon within 8 hours of ingestion, regardless of the presence of signs and symptoms of intestinal obstruction.

Résumé

Le but de cette étude a été de déterminer si l'Urografin ® peut aider le chirurgien dans la différenciation des occlusions d'intestin grêle complètes des occlusions incomplètes, et de savoir si l'on peut traiter les occlusions incomplètes de façon non opératoire. Cent seize patients ayant une occlusion postopératoire sans aucun signe de gravité toxique ont eu une étude par l'Urografin. Après administration d'un mélange de 40 millilitres (ml) d'Urografin et de 40 ml d'eau distillée à chaque patient, soit par la bouche soit par une sonde nasogastrique, et des radiographies ont été réalisées à 2, 4 à 8 heures. On a considéré que les 74 patients (63.8%) pour lesquels le produit de contraste a atteint le côlon en moins de 8 heures étaient en occlusion incomplète; tous ces patients ont été traités avec succès par une rehydratation intraveineuse et une décompression par sonde nasogastrique. Les 42 patients restants (36.2%) chez lesquels le milieu de contraste n'avait pas atteint le côlon en moins de 8 heures ont été considérés comme étant en occlusion complète; 34 de ces patients (81.0%) ont dû être opérés alors que huit de ces patients (19.0%) ont été traités de façon conservatrice. Une occlusion intestinale complète par adhérences a été trouvée chez tous les 34 patients (100.0%) pendant la laparotomie. Malgré la présence de niveaux hydro-aériques sur les clichés d'abdomen sans préparation, un régime liquidien, suivi d'un régime léger a pu être donné aux patients chez lequel l'Urografin a été retrouvé dans le côlon. En cas d'occlusion incomplète tous les patients ont été traités avec succès sans opération. La sensibilité, la spécificité et la précision de la présence d'Urografin dans le côlon en moins de huit heures après ingestion étaient, respectivement, de 90.2%, 100%, et 93.1%. L'Urografin, un milieu de contraste hydrosoluble sur et fiable, peut être utilisé pour différencier l'occlusion intestinale complète de l'occlusion incomplète. Un des avantages majeurs de l'Urografin est la possibilité d'assurer une alimentation orale précoce; le potentiel de raccourcir la période de traitement

conservateur de l'occlusion intestinale postopératoire doit être le sujet d'investigations ultérieures.

Resumen

El propósito del presente estudio fue determinar si la Urografina permite diferenciar entre una obstrucción intestinal completa y una parcial, y si la obstrucción intestinal parcial puede ser tratada por métodos no operatorios. Cientodieciséis pacientes con obstrucción postoperatoria del intestino delgado y libres de signos de toxicidad fueron sometidos a estudio con Urografina mediante la administración oral o por vía de tubo nasogástrico de 40 mililitros (ml) de Urografina mezclada con 40 ml de agua destilada. Se tomaron radiografías simples de abdomen a las 2, 4, y 8 horas. Setenta y ocho pacientes (63.8%) en quienes el medio de contraste llegó al colon en el curso de las primeras 8 horas fueron considerados como casos de obstrucción parcial y pudieron ser tratados exitosamente con hidratación intravenosa y descompresión nasogástrica. Los 42 pacientes restantes, en quienes el medio de contraste no llegó al colon en las primeras 8 horas, fueron considerados como casos de obstrucción total, y 34 de ellos (81,0%) fueron sometidos a cirugía, en tanto que 8 (19,0%) recibieron tratamiento conservador. En todos los 34 operados (100%) se encontraron adherencias. A pesar de la presencia de niveles aerolíquidos en la radiografía simple de abdomen o de dolor abdominal, se pudo dar dieta liquida seguida de dieta blanda a aquellos pacientes en quienes la Urografina avanzó hasta el colon. Todos los casos de obstrucción parcial fueron tratados en forma exitosa con métodos no operatorios. La presencia de la Urografina en el colon dentro las primeras 8 horas de su administración es indicación para tratamiento no operatorio, con una sensibilidad de 90,2%, una especificidad de 100% y una certeza de 93,1%. La Urografina, un medio de contraste hidrosoluble, seguro y confiable, puede ser utilizada para diferenciar entre una obstrucción intestinal parcial y una obstrucción total. La alimentación oral precoz representó una ventaja mayor del uso de la Urografina en el presente estudio. El potencial uso de la Urografina para acortar el período de manejo conservador de la obstrucción postoperatoria del intestino delgado merece investigación adicional.

References

1. Tanphiphat, C., Chittmittrapap, S., Prasopsunti, K.: Adhesive small bowel obstruction: a review of 321 cases in a Thai hospital. Am. J. Surg. *154*:283, 1987
2. Mucha, P., Jr.: Small intestinal obstruction. Surg. Clin. North Am. *67*:597, 1987
3. McEntee, G., Pender, D., Mulvin, D.: Current spectrum of intestinal obstruction. Br. J. Surg. *74*:976, 1987
4. Richards, W.O., William, L.F., Jr.: Obstruction of the large and small intestine. Surg. Clin. North Am. *68*:355, 1988
5. Brolin, R.E.: Partial small bowel obstruction. Surgery *95*:45, 1984
6. Deutsch, A.A., Eviatar, E., Gutman, H., Reiss, R.: Small bowel obstruction: a review of 264 cases and suggestions for management. Postgrad. Med. J. *65*:463, 1989
7. Seror, D., Feigin, E., Szold, A., Allweis, T.M., Carmon, M., Nissan, S., Freund, H.R.: How conservatively can postoperative small bowel obstruction be treated? Am. J. Surg. *165*:121, 1993
8. Brolin, R.E., Krasna, M.J., Mast, B.A.: Use of tubes and radiographs in the management of small bowel obstruction. Ann. Surg. *206*:126, 1987
9. Sosa, J., Gardner, B.: Management of patients diagnosed as acute intestinal obstruction secondary to adhesions. Am. Surg. *59*:125, 1993
10. Chung, C.C., Meng, W.C.S., Yu, S.C.H., Leung, K.L., Lau, W.Y., Li, A.K.C.: A prospective study on the use of water-soluble contrast follow-through radiology in the management of small bowel obstruction. Aust. N.Z. J. Surg. *66*:598, 1996
11. Ellis, H.: Adhesions: an introduction. In: Adhesions: The Problems, H. Ellis, M. Lennox, editors. London, Westminster Hospital Medical School, 1983, pp 1–5
12. Goldberg, E.P., Sheets, J.W., Habal, A.E.: Peritoneal adhesions: prevention with the use of hydrophilic polymer coating. Arch. Surg. *115*:776, 1980
13. Jones, P.F., Munro, A.: Recurrent adhesive small bowel obstruction. World J. Surg. *9*:868, 1985
14. Holmdahl, L., Risberg, B.: Adhesions: prevention and complications in general surgery. Eur. J. Surg. *163*:168, 1997
15. Assalia, A., Schein, M., Kopelman, D., Hirshberg, A., Hasmonai, M.: Therapeutic effect of oral Gastrografin in adhesive, partial small-bowel obstruction: a prospective randomized trial. Surgery *115*:433, 1994
16. Hofstetter, S.R.: Acute adhesive obstruction of the small intestine. Surg. Gynecol. Obstet. *152*:141, 1981
17. Ericksen, A.S., Krasna, M.J., Mast, B.A., Nosher, J.L., Brolin, R.E.: Use of gastrointestinal contrast studies in obstruction of the small and large bowel. Dis. Colon Rectum *33*:56, 1990
18. Foley, M.J., Ghahremani, M.D., Rogers, L.F.: Reappraisal of contrast media used to detect upper G.I. perforation: comparison of water-soluble media with barium sulfate. Radiology *144*:231, 1982
19. Watkins, D.T., Robertson, C.L.: Water-soluble radiocontrast material in the treatment of postoperative ileus. Am. J. Obstet. Gynecol. *152*:450, 1985
20. Strodahl, A., Laerum, F., Gjolberg, T., Enge, I.: Water-soluble contrast media in radiography of small bowel obstruction. Acta Radiol. *29*:53, 1988
21. Caniano, D.A., Beaver, B.L.: Meconium ileus: a fifteen year experience with forty-two neonates. Surgery *102*:699, 1987
22. Feigin, E., Seror, D., Szold, A., Carmon, M., Allweis, T.M., Nissan, A., Gross, E., Vromen, A., Freund, H.R.: Water-soluble contrast medium has no therapeutic effect on postoperative small-bowel obstruction: results of a prospective, randomized clinical trial. Am. J. Surg. *171*: 227, 1996