

# Diagnostic Peritoneal Lavage in Evaluating Acute Abdominal Pain

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A study was performed to determine the value of peritoneal lavage in the acute abdomen not related to trauma. Lavage was performed in 33 patients in the evaluation of abdominal pain of sufficient degree to warrant consideration for surgical intervention. Peritoneal lavage was truly positive or truly negative in 64% of the cases. It showed false negative results in 28% and false positive results in 8%. The lavage was most accurate in the evaluation of appendicitis, colonic disease, and intra abdominal bleeding. It was highly inaccurate in the evaluation of cholecystitis and peptic ulcer disease. It was concluded that the peritoneal lavage can be a useful adjunct in the evaluation of patients with abdominal pain and should be considered in difficult diagnostic problems but not routinely employed.

**M**AKING the diagnosis of the cause of acute abdominal pain and deciding whether to operate or not is often difficult. Diagnostic peritoneal lavage has been proven to be of value in the assessment of intra abdominal injuries from blunt trauma.<sup>7,9-12</sup> Because of its value in these conditions, it was felt it might be of value in assessing acute abdominal problems not related to trauma. Its use for this purpose has already been suggested by Gjessing and Denker,<sup>4</sup> but no objective data was published. This study was undertaken to determine what values might be applied to the laboratory analysis of peritoneal lavage fluid that could serve as a criteria for making the diagnosis of abdominal conditions requiring surgery and for deciding whether or not to operate.

## Materials and Methods

Peritoneal lavage was performed as part of the evaluation of abdominal pain in 33 patients at the Minneapolis Veteran's Administration Hospital. There were 15 cases in which clinical indications for surgery were present with fairly clear preoperative diagnosis of the causes of their abdominal pain. These cases were rather classic

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cases of appendicitis, acute cholecystitis, visceral perforation or such conditions where the diagnosis was easily made with standard clinical studies. There were 18 other cases with acute abdominal pain of the severity sufficient to warrant a surgical consult, but in which the findings were not typical enough to indicate a clear cut etiology. In the first group with clinically apparent disease, peritoneal lavage was performed in the operating room after induction of anesthesia. It was done using a small hole in the peritoneum in the central portion of the incision before the whole incision was opened. In the other cases, peritoneal lavage was performed under local anesthesia while the patient was in the ward, as described by Perry.<sup>8</sup>

To perform the diagnostic lavage, a peritoneal dialysis catheter (Stylocath-Abbott Laboratories) was introduced into the peritoneal cavity under direct vision. Aspiration of gross blood, bile, or intestinal contents constituted a grossly positive test. If grossly negative, a liter of lactated Ringer's solution was run into the peritoneal cavity and then allowed to drain back into the original bottle by gravity. Three separate 10 ml aliquots of the fluid were sent to the clinical laboratories for analysis. One sample was analyzed for red and white blood cells per cubic millimeter and a differential count was done on the white cells. A second aliquot was analyzed for amylase (Somogyi units per 100 ml) and for glutamyl oxylate transaminase (Carmen units per ml). The third sample was sent for bacterial culture and then centrifuged and the precipitate stained with Gram stain for bacteria. The results of the laboratory analyses of the peritoneal lavage fluid were evaluated using the criteria of Perry and Strate;<sup>10</sup> red blood cell counts above 100,000/mm,<sup>3</sup> white blood cell counts above 500/mm,<sup>3</sup> amylase levels above

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TABLE 1. *Peritoneal Lavage Values: Accurate Results*

True Positive	White Blood Cells (cells/mm <sup>3</sup> )	Blood Cells (%PMN/%Mono)	Red Blood Cells (Cells/mm <sup>3</sup> )	Amylase (Somogyi Unit %)	Gram Stain	Where Performed
I Appendicitis:						
a. Acute—no perforation	2,500	90/10	591	130	neg	OR
	700	98/2	—	5	neg	OR
b. Ruptured with Free Pus	750	58/42	250	3	neg	
	2,600	90/10	440	260	G+ Cocci&Rods	OR
	100,000	—/—	100,000	—	G- Cocci&Rods	OR
c. Ruptured with Local abscess	570	—/—	0	265	neg	OR
II Cholecystitis:	1,100	95/5	2,800	58	neg	OR
III Colon Disease:						
a. Diverticulitis	970	95/5	30	1	neg	OR
	1,280	95/5	210	0	neg	OR
b. Perforation	2,800	—/—	30	87	G-Rods	OR
	5,300	93/7	5,600	2	neg	OR
IV Other:						
a. Delayed rupture of spleen	175	29/71	110,000	15	neg	Ward
b. Leaking Aortic Aneurysm	—	—/—	Gross Blood	15	neg	Ward

100 Somogyi units/100 ml and the presence of bacteria were considered to be a positive peritoneal lavage. The results of peritoneal lavage were correlated with the final diagnosis of the case as determined at surgery in 18 cases, at autopsy in one case or by clinical judgment and the hospital course of the patient in the remaining 14 cases. In addition to the clinically ill patients, three patients underwent peritoneal lavage in the operating room prior to elective abdominal surgery for non-acute conditions. The three patients served as controls.

### Results

The data on all patients in which the peritoneal lavage values accurately reflected the clinical conditions are listed in Tables 1 and 2 and the data where the values did not reflect the true clinical conditions are listed in Table 3. True positive results were considered to be those in which surgery was indicated in the management of the condition and any one of the previously stated criteria were positive. True negative results were those in which

surgery was not indicated and none of the criteria were positive. Using this means of analysis, accurate results were obtained in 21 of the 33 cases, or 64%. Nine cases (28%) were falsely negative in that completely normal peritoneal lavage values were reported despite the presence of intra-abdominal infectious problems or surgical diseases. Two cases (8%) were classed as false positive because of a white count elevation in one case, and because of a report of Gram positive cocci on the stain of the precipitate in the other. In neither was surgery truly indicated.

Even though amylase and transaminase concentrations and Gram stains were obtained in all specimens, the red and white blood counts alone could have been used as criteria for positive or negative and the results of the study would have been the same. Transaminase levels were always low or normal and hence were not even tabulated. Only once was the Gram stain reported positive when the white count was not over 500 per cubic ml and that proved to be a false reading. The differential

TABLE 2. *Peritoneal Lavage Values: Accurate Results*

True Negative	White Blood Cells (cells/mm <sup>3</sup> )	Blood Cells (%PMN/%Mono)	Red Blood Cells (cells/mm <sup>3</sup> )	Amylase (Somogyi Unit %)	Gram Stain	Where Performed
I Cecal Dilatation due to ileus	27	44/56	1,683	20	neg	OR
II Pancreatitis	22	81/19	0	50	neg	Ward
III Granulomatous Colitis	480	76/24	350	27	neg	Ward
IV Abdominal pain, unknown etiology	100	77/23	60,000	13	—	Ward
	50	32/68	16,000	43	neg	Ward
	20	80/20	1,200	13	neg	Ward
	460	86/20	130	14	neg	Ward
	0	—/—	60	2	neg	Ward
	5	16/84	17	50	neg	Ward

TABLE 3. *Peritoneal Lavage Values: Erroneous Results*

False Negatives	White Blood Cells (cells/mm <sup>3</sup> )	White Blood Cells (%PMN/%Mono)	Red Blood Cells (cells/mm <sup>3</sup> )	Amylase (Somogyi Unit %)	Gram Stain	Where Performed
I Appendicitis:						
a. Acute—no perforation	60	60/40	4,800	—	neg	OR
b. Ruptured with localized abscess	6	—/—	500	13	neg	OR
II Cholecystitis:	0	—/—	10	4	neg	Ward
	9	55/45	2	0	neg	OR
	29	77/21	0	17	neg	OR
III Duodenal Ulcer:	4	—/—	0	27	neg	Ward
IV Other:						
a. Incarcerated inguinal hernia	60	60/40	4,800	—	neg	Ward
b. Diverticulitis with perforation of splenic flexure of colon	5	—/—	1,200	26	neg	Ward
c. Pelvic abscess, carcinomatosis, intest. obst.	5	0/100	50	—	neg	OR
False Positive						
I Post-op glove starch granulomas	8,000	11/89	10	61	neg	Ward
II Carcinoma of pancreas	10	—/—	54	13	neg	Ward

count on the white blood cells indicated greater than 90% polymorphonuclear cells whenever the white count was elevated except for two cases. One case of spontaneous delayed rupture of the spleen and one case of peritoneal carcinoma were reported as having predominantly a monocyte elevation in the peritoneal fluid.

Three patients had elevated amylase levels. All three were in cases with free peritoneal pus or visceral perforation. The one patient eventually diagnosed as having acute pancreatitis did not have an elevated amylase in the peritoneal lavage fluid.

Eight patients had the clinical diagnosis of appendicitis made and in 6 of these, the peritoneal lavage was positive. This gives a 75% accuracy for appendicitis. One of the false negative taps for appendicitis was in a patient with a mildly inflamed appendix and it is understandable this could be missed. The second person, however, had a ruptured appendix and a localized abscess; this inflammatory reaction was in no way reflected in the peritoneal lavage.

Colonic disease was also usually reflected in the peritoneal lavage. Two cases of diverticulitis without per-

foration showed positive lavages. Here again, however, one patient with diverticulitis and a well localized perforation had a normal peritoneal lavage.

Bleeding conditions within the peritoneal cavity were accurately reflected by peritoneal lavage and proved very effective in detecting a case of delayed rupture of the spleen presenting with abdominal pain and a case of a leaking aortic aneurysm that was not clinically apparent at the time of admission to the hospital. Both had positive red blood counts on their lavage and these findings significantly influenced the course of the management of these patients in that they were rapidly taken to the operating room for treatment of their condition.

Several conditions were poorly reflected by peritoneal lavage. Peritoneal lavage proved highly inaccurate in cholecystitis; only one of four cases had a positive tap. The one case of acute duodenal ulcer had a normal tap. Incarcerated internal hernia was also not reflected by peritoneal lavage.

The three patients who had peritoneal lavage performed as part of an elective surgical procedure to determine normal values are listed in Table 4. All three of

TABLE 4. *Peritoneal Lavage Values: Normals*

	White Blood Cells (cells/mm <sup>3</sup> )	White Blood Cells (%PMN/%Mono)	Red Blood Cells (cells/mm <sup>3</sup> )	Amylase (Somogyi Unit %)	Gram Stain	Where Performed
I As reported by Perry, et al. <sup>5</sup>	<500	—/—	<100,000	<100	neg	Ward
II Normal Controls						
Patient 1	18	0/84	162	23	neg	OR
Patient 2	4	—/—	24	13	neg	OR
Patient 3	5	—/—	738	10	neg	OR

these had negative lavage values as set by a much larger patient group reported by Perry and Strate.<sup>10</sup>

### Discussion

The purpose of this study was to determine the value of peritoneal lavage in the diagnosis of acute abdomen not related to trauma. The results indicate that it can be a useful adjunct in making that diagnosis but does not always reflect the true pathology present. In this study, nearly 2/3 of the patients had accurate reflections of their abdominal conditions. This accuracy is nowhere near the accuracy reported in its use in the diagnosis of abdominal injuries secondary to trauma. Perry and Strate<sup>10</sup> reported its use in 401 patients with only 0.7% false positive and 0.5% false negative results. The test was accurate in over 98% of their cases.

Laboratory studies have indicated that peritoneal lavage should be useful in the diagnosis of acute abdomen in the absence of trauma. Root and his associates<sup>12</sup> introduced gastric juice, bile, urine, blood and feces into the peritoneal cavity of dogs and demonstrated a peritoneal leukocytosis by peritoneal lavage. Ghanem and co-workers demonstrated a peritoneal leukocytosis following experimental superior mesenteric artery ligation in the dog, rat and mouse. Ghanem, Borner and Goodale<sup>1</sup> also demonstrated a potent leukotactic factor of small molecular weight in the peritoneal fluid after experimental superior mesenteric artery ligation in the rat. Waterman and Walsky<sup>13</sup> found an increased level of amylase in the peritoneal fluid of guinea pigs during acute experimental pancreatitis.

Paracentesis has been advocated for making the diagnosis of the acute abdomen but has the disadvantage of having a high percentage of "dry taps"; the small amount of specimen obtained when lavage fluids are not employed makes laboratory analysis impossible<sup>7</sup> and a small but definite incidence of perforation of the bowel also occurs.<sup>6</sup> Keith and associates<sup>5</sup> demonstrated an increased amylase level in the existing peritoneal fluid of patients with pancreatitis, high intestinal fistulas, perforated peptic ulcers and strangulated small intestine. Gjessing and Dencker<sup>4</sup> reported the use of peritoneal lavage in evaluating acute abdominal pain in 7 patients. They did not report laboratory values for the fluid and apparently only examined the fluid grossly. They considered the test to be of value in their 7 cases.

All lavages in the current study were performed without complications. Perry and associates<sup>10</sup> reported only 4 complications in over 800 peritoneal lavages employing the direct peritoneal approach; so the procedure is relatively safe.

A serious error occurs if surgery is performed because of false positive lavage. This study had two such cases. One of our false positive cases had a positive Gram stain

as the single criteria to make it positive. The other one had a leukocytosis but the differential count indicated a high monocyte percentage. On the basis of these two cases, one should perhaps not use the Gram stain as sole criteria for declaring the lavage positive and a high monocyte count should make one doubt the significance of a leukocytosis especially if splenic problems are not a consideration.

In summary, this study shows that leukocytosis of greater than 500 cells/mm<sup>3</sup> is the best indicator of a positive peritoneal lavage but a differential count should be obtained. The accuracy of the test is best in evaluating appendicitis or colonic disease but is not accurate in upper intestinal diseases. Bleeding diseases are accurately reflected. The study suggests that peritoneal lavage can be useful in evaluating patients with abdominal pain but does not suggest that peritoneal lavage be advocated as a routine procedure in all patients. When the diagnosis proves to be particularly difficult, or the patient is in a morbid or confused state precluding accurate clinical evaluation, the procedure can be performed with minimal risk and sufficient accuracy to be of value in making the decision to operate or not to operate.

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