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A STUDY OF UTILITY OF DRAIN FLUID PH FOR RAPID DETECTION OF INFECTIOUS COMPLICATION AFTER ABDOMINAL SURGERY

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Abstract

Background: The onset of infectious complications following abdominal surgery may be insidious, their presence obscure and the diagnosis difficult.

Methods: A prospective study of patient in whom emergency laprotomy was performed and post operative abdominal drain fluid analysis was done by ph for rapid detection of infectious complications.

Results: In our study those patients who developed intraabdominal complications (Failure) there 65.3% of samples have pH <7.1 and 34% samples have pH >7.1.While in patients who considered cured & improved 76.62% samples have pH >7.1 & 23.37% have pH <7.1

Conclusion: The pH during the postoperative follow-up period to evaluate the potential for rapid, simple, and early detection of infectious complications following abdominal surgery.

Keywords: PH, Infection, Drain, Fluid.

INTRODUCTION

By definition, an exploratory laparotomy is performed with the objective of obtaining information that is not available via clinical and diagnostic methods. It is usually performed in patients with acute or unexplained abdominal pain, in patients who have sustained abdominal trauma, and occasionally for staging in patients with a malignancy.

The onset of infectious complications following abdominal surgery may be insidious, their presence obscure and the diagnosis difficult. Apart from the presence of bacteria in the otherwise sterile peritoneal fluid, there are no clear-cut clinical or laboratory criteria to diagnose an infectious complication following abdominal surgery. The clinical presentation is quite variable, as are criteria to justify reoperation. Polymorphonuclear leukocyte cell count in peritoneal fluid has been suggested as a diagnostic criterion.[9] However, clinical and laboratory signs such as leukocytosis, fever, local tenderness, erythema, elevated erythrocyte sedimentation rate and C-reactive protein, which are used to detect infectious complications, are nonspecific indicators. Furthermore, in some elderly, immunocompromised or neutropenic patients as well as in polytraumatized patients, characteristic clinical signs of infection may be absent. Direct evidence of bacteria may be obtained by Gram stain or culture. However, these methods are time consuming and require a microbiological laboratory. Therefore, rapid, easy, sensitive and specific screening tests to diagnose a postoperative infection are needed. Measurements of pH, pO_2 and pCO_2 in peritoneal and drainage fluid have been found to reliably discriminate between the presence and absence of abdominal bacterial infection. Presence of infection was associated with pH < 7.1, pO_2 <6.5 kPa and pCO_2 > 8.0 Kp.[1] Acidic pH was found in the specimens sampled from patients considered therapeutic failures.[2] The clinical usefulness of the previously established threshold values for pH, pO_2 and pCO_2 was considered in the prospective study. The pO_2 and pCO_2 of peritoneal fluid were monitored in addition to pH during the postoperative follow-up period to evaluate the potential for rapid, simple, and early detection of infectious complications following abdominal surgery.

MATERIAL AND METHODS

Under the guideline of professional ethics &informed consent of each patient required data collection shall be done.

SOURCE OF DATA

Patient in whom decision of emergency laprotomy has been made either clinically & radiologically and admitted to the department of General Surgery in Maharana Bhupal General Hospital attached to R.N.T. Medical College of Rajasthan University of Health Sciences.

Inclusion criterion

The patient who present with acute abdomen, blunt trauma abdomen, penetrating abdominal injury and in which emergency laprotomy will be performed based on clinical and radiological findings and abdominal drain placement done.

Exclusion criterion

The patients in whom elective laprotomy is performed (any malignancy in abdomen, bile duct stone etc.) is not included in the study criterion.

TYPE OF STUDY

A prospective study of patient in whom emergency laprotomy was performed and post operative abdominal drain fluid analysis was done by ph for rapid detection of infectious complications.

METHOD AND COLLECTION OF DATA

Patients with perforated duodenal ulcer, perforated sigmoid diverticulitis, peforated appendicitis, intestinal obstruction, blunt trauma abdomen, penetrating abdominal injury, intra abdominal abscess and other complicated cases will be included and decision for emergency laprotomy will be made on clinical and radiological findings. All patients shall be managed in the pre-operative set up with IV Fluids, antibiotics and analgesics while keeping them nil by mouth.

All blood and radiological investigations will be done in accordance to the protocol set up of the hospital.

Intra operatively bilateral or unilateral abdominal drain placement would be done as per indication. Post operatively drain fluid pH will be sent daily to the clinical laboratory until the liquid drainage tube was pulled up. All patients will have a daily clinical evaluation for fever, bowel function and wound healing and once a week drainage fluid will be obtained for Gram stain and bacterial culture for aerobic and anaerobic organisms. Then the patients will be studied and grouped based on the values of abdominal drain fluid pH. Comparison of pH values would be attempted among patients without any post operative complication and the patients developing intra-abdominal complications (intraabdominal abscess, anastamotic breakdown, faecal fistula, post operative paralytic ileus, ascitis etc.)

OBSERVATIONS

In my study emergency exploratory laprotomy is done more commonly in males as compared to females with male to female ratio of 9:1. In my study the most common age group in which emergency exploratory done is in between 30-39 & second most common age group is >50 years.

Table 1: Distribution according to etiology and sex

Etiology	Male		Female		Total	
	No.	%	No.	%	No.	%
Duodenal perforation	17	47.2	1	25	18	45
Gastric perforation	2	5.5	0	0	2	5
Ileal perforation	8	22.2	1	25	9	22.5
Appendicular perforation	2	5.5	0	0	2	5
Intestinal obstruction	5	13.8	1	25	6	15
Pyoperitoneum	1	2.7	1	25	2	5
Rectal perforation	1	2.7	0	0	1	2.5
Total	36		4		40	100

In my study the most common etiology for which emergency exploratory laprotomy done is duodenal perforation which is 47.2% of total & second most common etiology is ileal perfopation. Duodenal perforation is most common in males.

Table 2: Outcome of patient

Type	No. of cases	%
Cured	14	35
Improved	19	47.5
Failure	7	17.5

In our study 47.5% of patients are those who developed subcutaneous wound infection. 35% of the patients do not developed any post operative complications & discharged. 17.5% of the patients developed post operative intra abdominal complications.

Table 3: Range of pH

	<7.1		≥7.1	
	No. of samples	%	No. of samples	%
Cured and improved	54	23.37	177	76.62
Failure	32	65.3	17	34.69

In our study those patients who developed intraabdominal complications (Failure) there 65.3% of samples have pH <7.1 and 34% samples have pH >7.1.While in patients who considered cured & improved 76.62% samples have pH >7.1 & 23.37% have pH <7.1

Table 4: Patient who developed intra abdominal complications

Age of patient	Postop day	pH	Complication
20	3	6.5	Anastamotic leak
22	5	6.2	Anastamotic leak
50	6	6	Anastamotic leak
40	7	6.3	Anastamotic leak
26	7	6.8	Abd wall abscess
43	7	7.9	wound dehiscence
25	10	5.7	Faecal fistula

In our study the patients who developed post operative intraabdominal complications there pH values are less than 7.1, except in one patient where it is >7.1.

Table 5:

Parameter	Patients	Average	Range
pH	Failure	6.48	5.7-6.8
	Cured/Improved	7.33	6.94-7.78

In our study those patients who were considered cured and improved their average pH is 7.33 (6.94-7.78) while those who were considered failure there average pH is 6.48 (5.7-6.8).

DISCUSSION

The metabolic activity of the bacterial pathogens, as well as host defence activity, often alter milieu factors such as pH at the site of infection. Therefore, altered pH has been suggested as a criterion for the diagnosis of bacterial infection in abdominal as well as chest diseases. An acidic pH has also been recorded in infected peritoneal or ascetic fluid, as well as in abscesses in experimental models.

It has long been known that pathogenic bacteria can alter metabolic index such as pH by tissue destruction and the formation of end products of metabolism. In the case of abscesses which are circumscribed collections of purulent exudates caused by an acute or chronic infectious processes with concomitant tissue destruction and inflammation, antibiotic therapy has been notoriously unsuccessful at eradicating the infection .this impaired bactericidal

activity may impart, be due to the local changes in pH and may account for the frequent failure of the abscesses to resolve.

Abdominal cavity drainage fluid can be used as an early diagnostic tool of postoperative complications, and observing its characteristics can help us to judge and handle postoperative complications. In special situations, such as patients presenting with an accumulations of peritoneal fluid of unknown pathogenesis. In addition, determination of pH might be useful beyond abdominal surgery for diagnosis of infections, e.g., in patients with ascetic fluid or in patients using chronic ambulatory peritoneal dialysis, and possibly in patients with chest diseases or joint disorders.

In this study we address the diagnostic and prognostic significance of pH in samples from abdominal drainage fluid obtained after abdominal surgery.

Clinical indicators of infection are nonspecific for site and may be absent in immunocompromised patients. The need for a quicker method of accurately determining whether intraabdominal fluid is infected is paramount. It is desirable to have a quicker method of diagnosing infection than the use of bacterial culture. Such a diagnostic marker would help prevent unnecessary procedures and prevent delaying appropriate drainage, thus allowing a reduction in patient morbidity. In this study we compare the usefulness of abdominal drain fluid pH to the current gold standard bacterial culture.

In our study 14 out of 40 (35%) were considered cured and post operatively there recovery was uneventful .19 out of 40 patients (47.5%) considered improved, who developed subcutaneous wound infection. 33/40 i.e. 82.5% were cured and failure. And 7 patients (17.5%) were considered failure (anastamotic leak, faecal fistula, wound dehiscence, etc.)

Stassen et.al(1986)[3] in his study found 48/55 were cured and improved (87.27%) and 7/55 were failure (12.7%).

Measurement of the pH done in the postoperative abdominal drain fluid in the 34 patient who are having contaminated abdomen and 6 patient who is having non contaminated abdomen. A total of 280 samples were obtained from 40 patients. Simmen and Blaser (1993)[1] reported a pH <7.1 to be the most sensitive thresholds in discriminating the presence of bacterial infection in intraabdominal abscess and fluids. Based on previously established threshold values of pH <7.1 we also use this in our study to discriminate the patient who developed intraabdominal complication from those who do not developed any intra abdominal complications.

In our study 7 patients out of 40 developed intraabdominal complications. The differences in the pH in the patient who developed complication occur mostly after the 6 post operative day, but in 2 patient who undergo failure pH difference occur after day 2 and day 5.The average value of the pH for those who developed post operative intra abdominal complication is 6.48 (Range 5.7-6.8). Except in one patient the value of pH is 7.9

33 patients out of 40 have normal recovery and do not developed any post operative intra abdominal complications .There average pH in post operative abdominal drain fluid is 7.33 (Range 6.94 -7.78)

Simmen et al(1994)[3] in his study found that from the fourth post operative day significant differences occur between the patients who cured/improved from those who developed failure. Simmen etal(1994) in his study found that the range of pH in the patient who developed post operative complications is in between 5.9-7.1 (average 6.42).

Hanseler et al(1992)[4] in his study proposed a score ranging from 0 (normal) to 6 (severely ill) on the basis of pH values. The patients who developed postoperative infections after anastomotic breakdown and each of their score increased 1-2 days before the infection became clinically obvious reaching values ranging from 3-6.

CONCLUSION

In clinical practice pH, pO_2 and pCO_2 in drainage fluid can be measured in minutes since blood gas analyzers are standard equipments in most hospitals .In contrast, diagnosis of infection by conventional techniques, such as gram staining and particularly microbiological culturing, require more time and are more expensive. Measurements of pH, pO_2 and pCO_2 in drainage fluid lead to an earlier diagnosis of infectious complications following abdominal surgeries.

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