

Role of polymerase chain reaction of ascitic fluid and its correlation with adenosine deaminase levels in the diagnosis of abdominal tuberculosis

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ABSTRACT

Background: It is still difficult to diagnose tuberculosis as a source of abdominal pain. Due to the lack of non-invasive diagnostic testing, the diagnosis remains a problem. Determining the role of polymerase chain reaction (PCR) in ascitic fluid in the diagnosis of abdominal tuberculosis, we can conclude whether it is sensitive/specific or not and further its use in the diagnosis of abdominal tuberculosis. **Objective:** The objective of the study was to determine the role of PCR in ascitic fluid in the diagnosis of abdominal tuberculosis and also to correlate the ADA levels of ascitic fluid with the PCR report. **Materials and Methods:** This prospective comparative study includes 41 clinically suspected abdominal tuberculosis patients (age range 15–65 years) over a period of 2 years. A detailed history, clinical evaluation, and relevant investigations, including radiology, were done in all patients. Bacteriological or histological approaches had to support the diagnosis of abdominal tuberculosis, and PCR was also tested for *Mycobacterium tuberculosis* in ascitic fluid. **Results:** The mean age of patients was 31.71 ± 12.32 years with male:female ratio was 1.4:1. PCR was positive in 24 (58.8%) cases. A receiver operating characteristic curve showed that a cutoff value of 35.3 IU/L (AUC 0.998, $P < 0.001$) for the ADA level produced the best results as a diagnostic test for abdominal tuberculosis, yielding the following parameter values: Sensitivity 100%, specificity 94.1%, positive predictive value 96%, negative predictive value 100%, and diagnostic accuracy 97.56%. ADA values were significantly elevated during abdominal tuberculosis, indicating that ADA can still be a valuable diagnostic tool. **Conclusion:** Our findings indicate that ascitic fluid PCR is a safe tool for diagnosing it and should be tried at least before surgical intervention.

KEY WORDS: Abdominal Tuberculosis; Polymerase Chain Reaction; Ascitic Fluid; Adenosine Deaminase

INTRODUCTION

Abdominal tuberculosis is still a daunting specialist condition. The organism, though prevalent in developed nations and the frequency is expected to rise in developed and developing countries following the HIV pandemic. In HIV-negative patients, the incidence ranging from 15 to 20% of all TB cases and while in HIV-positive cases, it accounts

for 40–50% of new TB cases.^[1] Gastrointestinal tract TB in India is the fourth most commonly associated location of extrapulmonary TB following pleura, lymph nodes, and bones.^[2]

Abdominal TB originates primarily from *Mycobacterium tuberculosis* and *Mycobacterium bovis*, although nontuberculous mycobacteria can also cause gastrointestinal disease in HIV positive or immunocompromised patients.^[3]

The clinical characteristics of abdominal tuberculosis are unspecific, and the diagnosis may be difficult to establish in the absence of pulmonary TB.^[4,5] Conventional approaches for abdominal TB diagnosis such as histopathology and solid media culture lead to low sensitivity (ranging from

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0 to 40%) and high processing times. For the diagnosis of abdominal TB, other tests such as BACTEC MGIT 960, adenosine deaminase levels (ADA), and molecular tests such as polymerase chain reaction (PCR) have been used and have the benefit of being quicker and more responsive. In a few studies, the use of PCR was suggested to improve the sensitivity (30–82.6%) and specificity (95–100%) of abdominal TB diagnosis.^[6] Most of the PCR assays evaluated for abdominal TB diagnosis have targeted the gene IS6110, which was thought to give higher sensitivity to PCR assays.^[7] It has been shown, though, that some Indian strains of *M. tuberculosis* do not contain IS6110 or have a small number of copies of this gene and thus these cases are absent. These cases can be identified using a multiplex PCR method, including other well-characterized genes in the assay, such as *devR* for *M. tuberculosis* and 16SrRNA for *Mycobacterium* species recognition. It has been shown, however, that some Indian strains of *M. tuberculosis* do not contain IS6110 or have low copy numbers of this gene, so those cases are missing. These cases can be identified using a multiplex PCR method, including other well-genes in the assay, such as *devR* for *M. tuberculosis* and 16SrRNA for *Mycobacterium* species recognition. *DevR* is a part of *devR devS*, a 2-component regulatory mechanism that is expressed differently in virulent *M. tuberculosis* strains and is well-preserved.^[8] A multiplex PCR that targets these genes will improve detection sensitivity as well as recognize other pathogenic NTM that causes gastrointestinal disease.

In this study, for the diagnosis of tuberculous ascites, PCR had better specificity and positive predictive value (PPV) than ADA, but the sensitivity was no different from ADA. The drawbacks for PCR are: It requires more resources and advanced equipment than ADA, the cost is higher, the test results take more time, and not every hospital can set up PCR lab.

For abdominal tuberculosis, surgical intervention can become important for two reasons: Diagnosis and therapy. In patients with peritoneal and/or lymph node tuberculosis, diagnostic laparotomy is important for histopathological/microbiological diagnosis. Complications, including intestinal obstruction (acute, acute-on-chronic, and chronic), perforation, and peritonitis, are recommended for therapeutic surgery. Although, we evaluate to determine the role of PCR in ascitic fluid in the diagnosis of abdominal tuberculosis and also to correlate the ADA levels of ascitic fluid with PCR report.

MATERIALS AND METHODS

This prospective comparative study was performed in the Department of General Surgery, Institute of Medical Sciences, from September 2015 to June 2017. All patients of clinically suspected abdominal tuberculosis with ascites were included

in the study. Patients with perforation peritonitis or patients without ascites were excluded from the study. The study was reviewed and approved by the Institute Ethical Committee of Faculty of Medicine, Institute of Medical Sciences, Banaras Hindu University. Informed written consent was taken from all these patients before study participation. A detailed history, clinical evaluation, relevant blood investigations, and several radiological tests (abdominal ultrasound and computed tomography [CT]) were done in all patients. Bacteriological or histological methods had to support the diagnosis of abdominal tuberculosis, and PCR for *M. tuberculosis* was also tested in ascitic fluid. The amount of ascitic fluid ADA was calculated using the Giusti and Galanti methods.^[9]

Statistical analysis was conducted using the SPSS version 23.0 (IBM Inc USA) program. For continuous variables, Student's independent sample test and Mann-Whitney *U*-test were used. For categorical variables, χ^2 test and Fisher's exact test were used. Sensitivity, specificity, PPV, and negative predictive value (NPV) were calculated for the diagnostic utility of ADA. $P < 0.05$ was considered to be statistically significant.

RESULTS

This study includes 41 abdominal tuberculosis patients with a mean age of 31.71 ± 12.32 years ranging from 14 to 78 years. The majority of patients in our study were females (58.5%). The most common presenting symptom was chronic pain abdomen in 36 (87.8%) patients, vomiting, distension, and altered bowel habit present in 33 (80.5%), 32 (78%), and 23 (56.1%), respectively, loss of weight and appetite, fever were other common symptoms. Similarly, tenderness in 29 (70.7%) and rigidity and guarding in 29 (70.7%) were most common signs found followed by hyperactive bowel sounds in 14 (34.1%), lump in 6 (14.6%), and visible peristalsis in 9 (22%), respectively.

Of the total 41 patients, 18 (43.9%) patients had normal X-ray while rest had cavitation (19.5%), prominent markings (17.1%), and pleural effusion (19.5%). Similarly, X-ray abdomen presents normally in (36.6%) followed by air-fluid level (31.7%), ground-glass appearance (14.6%), and dilated bowel loops (17.1%). The most common finding in the ultrasonography (USG) abdomen is ascites in almost all patients but associated with dilated loops (39%), separate ascites (31.7%), mesenteric lymph node (12.2%), thickened ICR (4.9%), and appendicular lump (2.4%). Finally, contrast enhanced CT abdomen which was done only in the 53.7% patients with findings as ICR thickening/stricture in (26.8%), followed by ascites, pyoperitoneum, and lymphadenopathy. In this study, all cases were clinically diagnosed as abdominal tuberculosis, but PCR was found to be positive in 24 cases (58.5%). The distribution of patients according to initial clinical diagnosis is shown in Table 1.

Symptoms and signs were compared on the basis of PCR positivity, but no significant association was observed, all were comparable in both groups. USG and CT scan were also comparable in diagnosing various types of abdominal tuberculosis with ascites as a common finding. On comparing laboratory investigations, serum hemoglobin, total protein, albumin, and ascitic fluid ADA were found to be significantly associated with PCR results ($P < 0.05$). All these parameters were found to be associated with the PCR result in our study and rest parameters were not associated with the result.

Correlation between ascitic fluid ADA and other biochemical parameters is shown in Table 2. There were positive correlation ascitic fluid ADA levels with ascitic fluid absolute lymphocyte count, ascitic fluid protein, total serum protein, and serum albumin levels ($P < 0.05$) while there is negative correlation was observed in hemoglobin and ascitic fluid sugar ($P < 0.05$). No significant correlation between other parameters found, but it has been seen that total leucocyte count and ascitic fluid neutrophil decrease on increasing ADA values and ESR increases on increasing ADA levels.

Under the receiver operating characteristic (ROC) curve ADA level of 35.3 was found to significant with 100% sensitivity, 94.1% specificity, 96% PPV, 100% NPV, and 97.56% diagnostic

accuracy (AUC 0.998, $P < 0.001$) [Figure 1]. Association between ascitic fluid ADA and PCR was found to be significant at a cutoff level of ADA 35.3 IU/L [Table 3]. ADA (cutoff value 35.3 IU/L) sensitivity of PCR increases and 96% of the cases it was found that there was PCR positive whereas on ADA <35.3 and there were 100% negative PCR reports found. On comparing various laboratory investigations with ADA cutoff level, the mean hemoglobin, total protein, albumin, absolute lymphocyte, and sugar level were significantly high in ADA level >35.30 group as compared to ADA level <35.30 [Table 4].

Of 41 cases, 21 (51.2%) cases underwent surgical procedure and rest (48.8%) underwent conservative management. This shows approximately equal efficacy of both ways of management and does not have any significant diagnostic relationship. The most common procedure that was done was stricturoplasty (one case of jejunal stricture and rest are ileal stricture) followed by adhesiolysis. Right hemicolectomy was done for a single case. In multiple cases, mesenteric lymphadenopathy was present and mesenteric LN biopsy was done. Conservative management followed by antitubercular drugs showed equal efficacy with surgical procedures.

DISCUSSION

This research focused on epidemiological assessment, clinical presentation, diagnosis, and care of abdominal tuberculosis

Table 1: Distribution of patients according to initial clinical diagnosis ($n=41$)

Diagnosis	Frequency	Percent
Ascites	2	4.9
SAIO	14	34.1
Koch's abdomen	11	26.8
Ileal stricture/ICR thickening	7	17.1
Pyoperitoneum	2	4.9
Cocoon abdomen	2	4.9
Adhesive obstruction	1	2.4
Appendicular lump	2	4.9

Table 2: Correlation between ascitic fluid adenosine deaminase and other biochemical parameters

Parameters	Ascitic fluid adenosine deaminase	
	r-value	P value
Ascitic fluid count	0.105	0.514
Ascitic fluid absolute lymphocyte	0.352	0.024
Ascitic fluid neutrophil	-0.025	0.877
Ascitic fluid protein	0.321	0.041
Ascitic fluid sugar	-0.363	0.020
HB	-0.309	0.049
Total leukocyte count	-0.257	0.105
Total proteins	0.497	0.001
Albumin	0.546	<0.001
Erythrocyte sedimentation rate	0.128	0.477

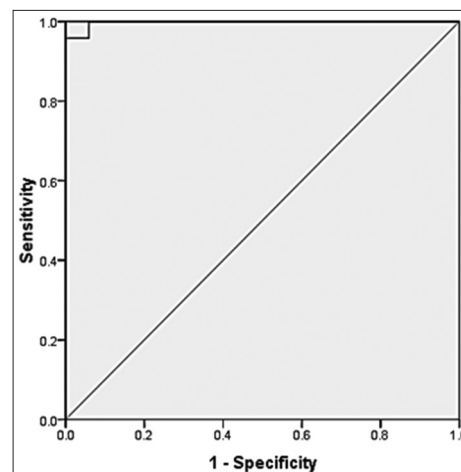


Figure 1: Receiver operating characteristic curve of adenosine deaminase level

Table 3: Association between ascitic fluid ADA and PCR

PCR	Ascitic ADA			
	Ascitic fluid ADA <35.30 ($n=16$)		Ascitic fluid ADA >35.30 ($n=25$)	
	n	%	n	%
Positive	0	0.0	24	96.0
Negative	16	100	1	4.0
Total	16	100	25	100

$\chi^2=37.045$, $P<0.001$. ADA: Adenosine deaminase, PCR: Polymerase chain reaction

Table 4: Comparison of various laboratory parameters with ADA cutoff level

Parameters	ADA <35.30 (Mean ± SD)	ADA >35.30 (Mean±SD)	P-value
HB	12.01±1.55	10.22±1.89	0.003
Total leukocyte count	11000.00±6153.54	8208.64±5460.61	0.142
Total proteins	5.70±1.06	6.66±1.22	0.014
ALB	2.79±0.93	3.75±0.95	0.003
Erythrocyte sedimentation rate	31.92±15.55	35.35±15.21	0.535
Ascetic count	1473.38±1356.16	1289.08±1048.75	0.535
Absolute lymphocyte	70.12±9.07	74.20±10.65	0.017
Neutrophil	17.69±7.71	18.36±7.86	0.214
Protein	3.38±1.14	3.89±0.89	0.789
Sugar	75.06±22.26	60.56±21.59	0.045

ADA: Adenosine deaminase

patients. Most of abdominal tuberculosis patients presented in the age group of 21–30 years and 11–20 years which were 26.8% and 22%, respectively. There was a preponderance of female patients in our study. Symptoms and signs were compared on the basis of PCR positivity, but no significant association was observed. USG and CT scan were also comparable in diagnosing various types of abdominal tuberculosis with ascites as a common finding. Serum hemoglobin, total protein, albumin, and ascitic fluid ADA were found to be significantly associated with PCR result ($P < 0.05$). There were positive correlation ascitic fluid ADA levels with ascitic fluid absolute lymphocyte count, ascitic fluid protein, total serum protein, and serum albumin levels ($P < 0.05$) while there is negative correlation was observed in hemoglobin and ascitic fluid sugar ($P < 0.05$). Under the ROC curve, ADA level of 35.3 was found to significant with 100% sensitivity, 94.1% specificity, 96% PPV, 100% NPV, and 97.56% diagnostic accuracy (AUC 0.998, $P < 0.001$). Association between ascitic fluid ADA and PCR was found to be significant at cutoff level of ADA 35.3 IU/L. On comparing various laboratory investigations with ADA cutoff level, the mean hemoglobin, total protein, albumin, absolute lymphocyte, and sugar level were significantly high in ADA level >35.30 group as compared to ADA level <35.30. Of 41 cases, 21 (51.2%) cases underwent a surgical procedure, and rest (48.8%) underwent conservative management. This shows approximately equal efficacy of both ways of management and does not have any significant diagnostic relationship. Conservative management followed by antitubercular drug showed equal efficacy with surgical procedures.

In our study, most of abdominal tuberculosis patients presented in the age group of 21–30 years and 11–20 years which were 26.8% and 22%, respectively. According to Wig *et al.*^[10] the majority of patients were in 21–30 years and 31–40 years which were 50.7% and 20.5%, respectively. Another study by Bhansali^[11] found the age group 21–30 years and 31–40 years which were 41% and 25%, respectively. There was a preponderance of female patients, which was found to be 58.5%, while 41.5% were male in our study. As compared with other studies, Wig *et al.*^[10] observed that 32.87% were

male and 67.12% were female in their study. According to Das *et al.*^[12] reported 72% of female as compared to 28% of male patients in their study.

In this study, pain abdomen was the main complaint of the patient who comes to the hospital where Bhansali,^[11] Das *et al.*,^[12] and Islam *et al.*^[13] series are 94%, 100%, 83.3% which is coincides with 87.8% of the present study and followed by bowel disturbance which was found in most of the studies along with the present study. In 56.1% of cases, altered bowel habit was one of the most common complaints present in this study. According to studies by Das *et al.* and Bhansali reported 64% and 65%, respectively.^[11,12] The other frequent symptoms in our study and studies by Das *et al.*, Bhansali, and Islam *et al.* were distension, vomiting, mass per abdomen, fever, and anorexia with weight loss.^[11-13] The present study shows that 70.7% of patients had abdominal tenderness. This result was comparatively similar to studies by Das *et al.*^[12] and Bhansali^[11] who showed 65.9% and 62.6%, respectively. Similarly, in our study, distension of the abdomen was present in 65.8% patients, which is a similar study done by Das *et al.*^[12] of 58.2% patients and 81.3% patients by Bhansali^[11] The rest of the signs were nearly comparable with studies in reference to our study.^[11-13]

In our study, about 47.4% of patients were anemic and in respect to ESR estimation, 71.1% of the patient of our study had an increase level of ESR, therefore elevated ESR level always associated with chronic infection and it can be considered for prognostic value. The mean hemoglobin and ascitic fluid sugar level were found to be significantly low in abdominal tuberculosis patients. The mean total leukocyte count, ESR, ascitic fluid ADA, ascitic fluid cell counts, lymphocyte count were significantly raised in abdominal tuberculosis patients.

In both chest X-ray and abdominal X-ray, most of the patients (56.1% and 63.4%, respectively) had abnormal findings. Chest findings were similar to pulmonary tuberculosis active/inactive. In an ultrasound abdomen, almost all patients had ascites and 91.2% of the patients had additional findings.

About 46.3% patients did not undergo CT-scan and rest showed pathological findings. The most common finding in the CT scan was stricture ileum followed by ascites and lymphadenopathy, as supported by Wig *et al.*^[10]

Diagnosis is complicated due to ambiguous symptoms and signs without the need for pathognomonic studies. In the present study, the accurate pre-operative diagnosis was made in 86% of patients, diagnosis of chronic pain abdomen, sub-acute intestinal obstruction, or mass per abdomen was more frequently accurate than in acute obstruction or atypical presentation. Das and Shukla working in an endemic area stated that only 50% of the cases were identified. In 69% of cases, Ecgleston *et al.*^[14] reported a pre-operative diagnosis.

ADA is aminohydrolase that converts adenosine-to-inosine. This enzyme activity is more in T-lymphocytes. Due to the activation of T-cells by mycobacterial antigens, ADA is increased in the tuberculous ascitic fluid. In the present study, some degree of ascites was found in all 41 patients, with ADA levels being estimated in all cases with mean ADA of (IU/L) is 70.902 ± 69.9261 . Patients were considered positive with $ADA = 35.3 \mu/l$ as a cutoff. Levels of ADA were substantially higher in tuberculous ascites than in cirrhotic or malignant ascites. According to the meta-regression analysis performed by Liao *et al.*^[15] and Tuon *et al.*,^[16] the cutoff between 33 and 35 IU/L for those who used the Giusti approach as the way to detect ADA.

In the present study, we evaluated abdominal TB patients by multiplex PCR for targeting three genes – IS6110, devR, and 16SrRNA. We contrasted the assay with simple PCR targeting individually each of these genes, and other traditional tests used to diagnose abdominal TB. Multiplex PCR could detect 28 of 37 (75.7%) cases of peritoneal TB. The ADA level estimate helped identify six additional cases, while ADA specificity was found to be lower (88%) than multiplex PCR (100%). Compared to other research, the sensitivity and specificity of multiplex PCR in the present study were relatively low [Table 5].

The low sensitivity of in-house PCR in the study could be because of several reasons. The extracted DNAs were stored

at -20°C for a long time and all the samples were subjected to PCR testing when the in-house PCR was standardized. The storage of the extracted DNA might have been detrimental to the quality of DNA. The reagents also were stored for longer periods after preparation. Precise analytical sensitivity of the in-house PCR could not be done due to a lack of research funds, as indicated above. We have used distilled water generated at our own laboratory. The commercially available DNase and RNase free water might increase sensitivity. The addition of reagents such as glycerol and DMSO to the reaction tube could not be tested. These and similar other methods need to be tested to increase the sensitivity of the in-house PCR.

In the present study, it was found that on increasing the value of ADA (cutoff value 35.3 IU/L) sensitivity of PCR increases and 96% of the cases, it was found that there was PCR positive whereas on $ADA < 35.3$ and there was 100% negative PCR reports found. The relationship between these two variables was found to be significant ($P < 0.001$). As supported by previous studies, it has been seen that on increasing ADA value PCR was sensitivity.

In the present study, it was seen that on cutoff value of ADA 35.3 IU/L Hb, serum total protein, albumin, and ascitic fluid lymphocyte count, sugar and protein were found to be significant. There was positive correlation of ADA value with ascitic fluid lymphocyte count ($r = 0.352$, $P = 0.024$), ascitic fluid protein ($r = 0.321$, $P = 0.041$), serum total protein ($r = 0.497$, $P = 0.001$), and albumin ($r = 0.546$, $P < 0.001$). Significant negative correlation was established with ascitic fluid sugar ($r = -0.363$, $P = 0.020$) and hemoglobin ($r = -0.309$, $P = 0.049$).

It was found that both of the management protocols were equally effective with a slight preponderance to the surgical mode in our study. About 48.8% of the patients were managed conservatively and rest of the patients underwent surgery along with antituberculous treatment.

Once the surgery is performed, the pathological results must be modified.^[17] An ileocaecal mass resection may be reduced (9.5%). Limited resection of the ileocecal region was reported by Pujari^[18] and Sharma *et al.*^[19] rather than the classical hemicolectomy (4.7%) because extensive resection of the bowel can cause malabsorption^[20] and strictures can be treated by stricturoplasty (19%) can be done.^[21] Even in emergency cases who underwent surgery, 46% of cases undergo limited resection and 4.7% cases undergo right hemicolectomy.

As compared to our study, 18% of the cases received limited resection in Ecgleston *et al.*^[14] series, although only 10% had limited resection in Islam *et al.* series. Right hemicolectomy was underwent in 63.3% and 12% cases, respectively, by Islam *et al.* and Ecgleston *et al.* series.^[13,14] Stricturoplasty was

Table 5: Comparison of sensitivity and specificity of multiplex PCR with other studies

PCR in various studies	Study PCR sensitivity (%)	Specificity (%)
Iqbal <i>et al.</i>	65.86	97
Tiwari <i>et al.</i>	75.67	88
Singh <i>et al.</i>	82	98
Negi <i>et al.</i>	74.4	94
Sharma <i>et al.</i>	90	94
Patwardhan <i>et al.</i>	90.1	96
Our study (2017)	58.5	93

PCR: Polymerase chain reaction

performed in 19% cases in our study, while it was performed in 36% cases in Eggleston *et al.*^[14] series. Only 3.3% cases underwent a similar procedure in Islam *et al.*^[13] series.

In our study, ileotransverse colon bypass was performed in 4.7% cases, while in Eggleston *et al.*, it was done in 18% of cases and in Islam *et al.*, it was done in 16.6% of cases.^[13,14] Bhansali^[11] also proposed that bypass patients would undergo a secondary excisional procedure after receiving authorization to test (ATT) and favorable conditions.

Operating morbidity in the current series was 12%, the most common complication being wound infection (10%). Eggleston *et al.*^[14] reported 36% morbidity while Islam *et al.*^[13] reported 8% morbidity in their series. Mortality in the present series was low, in total, four patients died (8%), all underwent emergency procedures, and in elective cases, no deaths were reported. Only Islam *et al.*^[13] have found low mortality than the current study and no cases have died in their sample. In a study by Eggleston *et al.*,^[14] it was found to be 3% in elective surgery and 18% in an emergency, while it was reported by Bhansali^[11] as 2% and 24%, respectively. Follow-up with 6 months of antitubercular therapy provided excellent results following surgery in 90% of cases.

In the present series, only one patient was expired in the post-operative period which underwent emergency surgery; the rest of the patients showed excellent results equivocal in both conservative and surgical methods. Three patients had burst abdomen as the main complication which was managed.

The major challenge in the diagnosis of abdominal tuberculosis is the demonstration of the *M. tuberculosis*. Conventional methods, including smear and culture of ascitic fluid, have poor sensitivity due to the low quantity of bacteria in the sample. For the smear to be acid-fast bacillus (AFB) positive, the sample should contain at least 10,000 bacilli/ml. The Lowenstein-Jensen culture method is still considered to be the gold standard but requires 10–100/ml viable bacilli to become positive. In addition, it needs 6–8 weeks' time for reporting because of which clinical and therapeutic decisions are difficult to make. Tissue diagnosis on histology requires laparoscopy or even laparotomy. Without a definitive demonstration of the cause, there is a delay in diagnosis and treatment. Therefore, a high suspicion index is needed to make an early diagnosis and to validate the diagnosis can require more than a procedure.

Ascitic fluid adenosine deaminase has a specificity of 97% and sensitivity of 100% for the diagnosis of tuberculosis where the cutoff values from 36 to 40 IU/L.^[21] Thus, ADA activity in patients with suspected peritoneal tuberculosis is a realistic and useful approach to making therapeutic decisions. Starting empirical antitubercular therapy and waiting for results of mycobacterial culture and biopsies when a patient has high ADA values is a successful strategy.

Estimating ascitic ADA levels is especially important where tuberculosis bacilli culture facilities are not available on tissue biopsy. A high ascitic value of ADA is highly predictive of tubercular etiology, although a low ascites value of ADA does not automatically preclude it from not being tubercular. Hence, the estimation of ascitic ADA levels when tubercular peritonitis is suspected in a simple, fast, inexpensive and least invasive diagnostic process, highly precise, and relatively sensitive.

There is a lot of literature concerning the role of PCR in extrapulmonary tuberculosis diagnosis. IS6110 as the target sequence for the detection of mycobacterial from extrapulmonary samples has shown a wide variation in sensitivity and specificity, Negi *et al.*^[22] reported 83% PCR positivity and Ogusuk *et al.*^[23] showed 91.2% of their samples be IS6110 positive. Amin *et al.*^[24] have reported a positivity rate of 38.6% in pus, 42.1% in cerebrospinal fluid, and 46.6% in urine. Maheshkumar *et al.*^[25] showed a number of PCR positives among 154 body fluid samples, that is, 27% in ascitic fluid, 22% in pleural fluid, and 36% in CSF. Response to antitubercular therapy or tissue diagnosis of tuberculosis or microbiological demonstration of AFB is considered the final diagnostic criteria against which PCR results are evaluated.

In this analysis, we admit a few limitations.

We admit some limitations in this study. First, this is a single-center study and the sample size was small. Second, due to the limited data, we were unable to analyze many variables, such as the status of HIV infection, other ascites etiology, and the age of patients, which may affect the immune status and effect of ADA ascites rates. Hence, it was not possible to ignore the unconscious prejudice.

CONCLUSION

Based on our experience, we recommend routine use of the PCR in cases of sub-acute intestinal obstruction and if positive, the cases should be managed conservatively. In PCR negative sub-acute obstruction, intervention should be done and ATT started in the post-operative period if histopathology is supportive of tuberculosis. Various symptoms, signs, imaging modalities and biochemical parameters, and diagnosis with management were evaluated and compared with ascitic fluid ADA and ascitic fluid PCR and found some of the values such as serum hemoglobin, total protein, albumin, ascitic fluid sugar, lymphocyte, and protein were significantly related and aid in the diagnosis and management of abdominal tuberculosis.

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