

# ACUTE APPENDICITIS – IMPORTANCE OF CLINICAL EXAMINATION IN MAKING A CONFIDENT DIAGNOSIS

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## ABSTRACT

**Objective:** To evaluate the importance of clinical examination in the diagnosis of acute appendicitis.

**Design:** An observational and descriptive study.

**Setting:** Department of surgery, Pakistan Institute of Medical Sciences, Islamabad and Islamic International Medical College Hospital Trust, Railway Hospital, Rawalpindi. The period was from October 2001 to January 2003.

**Patients & Methods:** The study includes 160 patients of acute appendicitis who had undergone appendectomy with preoperative diagnosis of acute appendicitis. They were analyzed prospectively. The parameters evaluated were age/gender, clinical presentation (signs & symptoms) total & differential leucocyte counts and urine microscopy. The operative findings were recorded and the inflammation of the appendix was graded into uncomplicated, complicated and normal. The results were assessed to establish the role of clinical examination and common laboratory tests (leucocyte count & urine microscopy) in the final diagnosis of acute appendicitis.

**Results:** The mean age was 23 years with male to female ratio of 1.6:1. Pain in the right iliac fossa was the most common symptom and tenderness in the right iliac fossa was the commonest physical sign (92%). The total leucocyte count was less than 10,000/mm<sup>3</sup> in 38.8% cases and more than 10,000/mm<sup>3</sup> in 61.2% cases. The sensitivity and specificity of raised TLC for acute appendicitis were 80% and 67% respectively. Eighteen out of 35 patients with abnormal urine microscopy had histopathological evidence of acute appendicitis. The overall diagnostic accuracy was 91.8%.

**Conclusion:** Clinical assessment is the best criteria to reach a confident diagnosis. Total leucocyte count and other investigations should be used as diagnostic aid in doubtful cases but they don't replace the clinical skills of General Surgeons.

**KEY WORDS:** Clinical examination, Appendicitis, Acute Leucocyte Count Urine, Microscopy

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## INTRODUCTION

Acute appendicitis is a common surgical condition and the diagnosis is made primarily on the basis of the history and the physical findings, with additional assistance from laboratory examinations. Although most patients with acute appendicitis can easily be diagnosed, for many of them the signs and symptoms are variable and a firm diagnosis can be difficult. This is particularly true when the appendix is in the retrocecal or the retroileal position. The percentage of appendectomies performed where the appendix is subsequently found to be normal varies between 15% and 30%<sup>1,2</sup> and postoperative complications can

occur in up to 50% of these patients.<sup>3</sup> Clinical judgment still remains the important diagnostic tool for acute appendicitis.<sup>4</sup> Diagnostic accuracy rates vary according to the patient population as well as the experience of surgeon. It is the best in young adult males and considerably poor at extremes of age i.e. in children and elderly patients. The greatest diagnostic challenge appears in females of child bearing age in their 3<sup>rd</sup> to 4<sup>th</sup> decade of life especially in the mid-portion of menstrual cycle.<sup>5</sup> Pelvic appendicitis in females may mimic pelvic inflammatory disease. Experienced surgeons can diagnose acute appendicitis accurately in more than 90% cases on clinical presentation of the patient, however in most cases junior surgeons and residents have to decide whether to operate or not. There is a general trend to rely on laboratory tests in patients with equivocal signs or some times even with convincing signs, in the final decision making regarding operation. Most commonly available laboratory tests are Total and Differential Leucocyte Counts (TLC & DLC) and urine microscopy. Some cases of acute appendicitis with normal white cell count or abnormal urine microscopy may be missed by the junior surgeons. Such patients present later on with various complications like appendicular mass, abscess or peritonitis due to perforation.<sup>4</sup> In the present clinical case study, the aim was to evaluate the importance of clinical examination and common laboratory tests (TLC, DLC & urine microscopy) in the diagnosis of acute appendicitis.

The purpose of study was to evaluate the reliability of clinical examination and common laboratory tests e.g total and differential white cell counts and urine microscopy in the diagnosis of acute appendicitis.

## PATIENTS AND METHODS

This study was conducted at Department of Surgery, Pakistan Institute of Medical Sciences, Islamabad and Islamic International Medical College Trust, Railway Hospital, Rawalpindi from October 2001 to January 2003. This study includes 160 patients with a clinical diagnosis

of acute appendicitis, who had undergone appendectomy. It includes all adult patients above 12 years age of either gender with clinical diagnosis of acute appendicitis. Patients presenting with appendicular mass who were managed conservatively were excluded. The patients were admitted through emergency department of the hospital. A detailed history was taken. Thorough physical examination and relevant laboratory tests (total and differential white cell count & urine microscopy) was done in all cases. The cases were assessed by the senior registrar or consultants and operated within 12 hours of admission. The decision to operate was made on the basis of history and clinical examination. Appendectomy was done by using Grid- iron muscle splitting or small transverse (Lanz's) incision. The operative findings were recorded and histopathology of removed appendix done in each case. The inflammation of appendix was graded as uncomplicated, complicated and normal. In patients with normal appendix other possible conditions responsible for the symptoms and abnormal laboratory findings were also noted. The data were entered into a predesigned performa and the results were assessed to establish the role of clinical examination with respect to white cell count and urine microscopy in the diagnosis of acute appendicitis.

## RESULTS

A total of 160 patients, 98 males and 62 females were studied who were operated upon for acute appendicitis after a clinical diagnosis. The male to female ratio was 1.6:1. The age distribution ranged from 12-65 years, mean being 23 years. The incidence of acute appendicitis was maximum in second and third decades of life (60% patients, 21-38 years).

Clinical presentation in 160 patients is summarized in table-I. The most consistent and frequent symptom was pain starting in upper abdomen in 52% (83 patients) patients and then shifting to right iliac fossa. In 6% cases pain became generalized. In 67% patients (107 cases) pain started early morning or after mid

Table-I: Summary of the clinical presentation of all 160 cases in this study

<i>Clinical Presentation</i>	<i>Patients % age (n=160)</i>
<b>Pain</b>	<b>100</b>
Pain right iliac fossa	52 (83)
Pain epigastrium which localized to RIF	14 (22)
Pain starts at umbilical region, later localized to RIF	34 (55)
Duration of pain <24 hours	71 (114)
Shifting of pain	42 (67)
Nausea	94 (150)
Vomiting	72 (115)
Anorexia	87 (139)
Fever between 99.2-101°F	67 (107)
Constipation	52 (83)
Diarrhea	8 (13)
Urinary complaints	22 (35)
Cough Sign	88 (140)
Tenderness right iliac fossa	92 (147)
Rebound tenderness	72 (115)
Muscle guarding	73 (117)
Rovsing's sign	55 (88)
Psoas test	50 (80)
Obturator test	23 (37)

night. A total of 114 patients (71%) presented within 24 hours of onset of complaints whereas 12 patients (8%) had history of more than 72 hours. Four female patients were pregnant at presentation. In 21% patients, there was complaint of past history of similar attacks, with mild to moderate pain in right lower quadrant.

On admission 67% patients had fever of variable degree. Majority of them had between 99.2-101°F. Fever was more marked (high grade) in cases of perforated or gangrenous appendices (25% cases). 88% patients felt pain on coughing. All the patients had tender right half of abdomen to variable degree of pressure. The site of tenderness was variable, but in majority (92% cases) in the right iliac fossa. Muscle rigidity and rebound tenderness were present in 73% and 72% of all patients respectively. These signs were constantly present and

Table-II: Total leucocyte count and histopathology of appendix

<i>Histopathology</i>	<i>TLC &lt;10,000 mm<sup>3</sup></i>		<i>TLC &gt;10,000 mm<sup>3</sup></i>	
	<i>Number</i>	<i>%</i>	<i>Number</i>	<i>%</i>
Acute Appendicitis	46	28.8	61	38
Gangrenous appendicitis	6	3.8	16	10
Perforated appendix	4	2.5	14	8.8
Normal appendix	6	3.8	7	4.4

more marked in all patients having gangrenous and perforated appendix. Rebound tenderness has high sensitivity rate in diseased appendices group, but its positively does not confirm acute appendicitis. Rovsing sign, psoas test and Obturator test were positive in more than 50 patients.

In this study, clinical diagnosis was the main stay but in every case total leucocyte count and differential leucocyte count were done. The mean hemoglobin level was 13.3 gm / dl (range 9.1-16.9) gm/dl. The total leucocyte count ranged from 4600 to 22,800/mm<sup>3</sup> (mean 9356.5/mm<sup>3</sup>). It was <10,000/mm<sup>3</sup> in 62 (38.8%) patients and > 10,000 /mm<sup>3</sup> in 98 (61.2%) cases. 74.3% patients with low TLC and 54.9% with TLC> 10,000/mm<sup>3</sup> presented with history of less than 24 hours. Only 4.4% (7 patients) cases having TLC <10,000 /mm<sup>3</sup> have history of longer than 72 hours. Neutrophilia of > 75% was found in 120 (75%) cases and 16 out of 40 patients with gangrenous or perforated appendix had a TLC of less than 10,000/mm<sup>3</sup>. After exclusion of cases with other surgical conditions necessitating exploration, the sensitivity and specificity of raised white cell count in acute appendicitis were 80 and 67% respectively. Table-II summarizes the correlation of leucocyte count with various grades of acute appendicitis. Urine microscopy showed haematuria or pyuria in 35 (22%) patients. Twelve patients (7.5%) with abnormal urine microscopy had histopathological evidence of acute appendicitis.

Appendix was retrocecal in 104(65%) and pelvic in 26 (16%) cases. Four (2.5%) patients had sub hepatic appendix. Appendix was gan-

grenous in 22(13.8%) and perforated in 18 (11.3%) cases. Macroscopically 16 appendices were found normal on the basis of naked eye appearance and after histopathology, 13 proved to be normal. So the negative appendectomy rate was 8.1%. (8 in females, 61.5% and 5 in males, 38.4%). The operative findings in patients having normal appendix included, Pelvic inflammatory disease, mesenteric lymphadenitis, ruptured ovarian cyst, inflamed Meckel's diverticulum. One male patient had omental torsion. The diagnosis in three patients remained uncertain. Urine Examination revealed pus cells more than 5-6/HPF in 20 patients, red blood cells in eleven patients and in 32 patients there were traces of albumin. Half of these were finally diagnosed as acute appendicitis. Overall diagnostic accuracy for acute appendicitis was 91.8%.

Postoperative nonspecific fever for one or two days was present in 28 cases (17.5%). Post operative complications were present in 24 patients (15%) and local wound infection was the most common among them. It ranges from stitch abscesses to deep infection. Local wound infection occurred more commonly in gangrenous appendix and after perforation. Superficial wound infection was present in 8 cases of uncomplicated acute appendicitis and 12 cases with complicated appendix. Deep wound infection was present in 4 cases of complicated appendicitis. No other serious complication was noted. There was no mortality in this study.

## DISCUSSION

The accurate clinical diagnosis of acute right iliac fossa pain remains a difficult clinical problem as the differential diagnosis of such pain is not always straightforward. Acute appendicitis is the most common non traumatic surgical emergency. In spite of all diagnostic modalities it is confusing for the clinician. The main concern relates to delay in diagnosis, leading to risk of perforation, abscess formation and increased morbidity. New diagnostic techniques such as estimation of C-reactive protein, peritoneal aspiration cytology, scoring and

computer analysis, graded compression ultrasonography, computed tomography, non contrast helical computed tomography and laparoscopy have been introduced in recent years.<sup>6</sup> The drawback with these techniques is involvement of additional costs and lack of free availability. Due to these factors these modalities have not gained wide acceptance as routine diagnostic investigations of acute appendicitis. The diagnosis of acute appendicitis is still primarily based on history and physical examination. In a study evaluating clinical assessment alone in diagnosing appendicitis, accuracy ranged from 83%-97% with values correlating with the surgeon's experience.<sup>7</sup> However most of the times the trainee residents are responsible to make the diagnosis and decide for appendectomy. They usually make the diagnosis on clinical grounds but used to further confirm it by obtaining a total and differential leucocyte count and urine microscopy. As a result they can be misled by a normal white cell count or abnormal urine microscopy despite a strong clinical impression of acute appendicitis. This may result in missing some genuine cases, who present later on with various complications. In the present study, we emphasized on the importance of clinical examination over laboratory findings in making a confident diagnosis of acute appendicitis.

Although true prevalence of acute appendicitis varies from country to country and race to race, it is not uncommon in our country. As it is said that appendicitis is the disease of younger age, our study supports this view but no age is immune to appendicitis. In this series maximum number of patients was seen in the second and third decades (60% between 21-38 years). In comparative international study the commonest age group was 10-30 years as 90%.<sup>8</sup> According to Amir M and Shami IH,<sup>2</sup> 44.8% cases were in their 2<sup>nd</sup> decade and 30% cases were in 3<sup>rd</sup> decade with a gradual decrease in incidence with age. Nazir A et al<sup>9</sup> in a series of 100 patients has quoted 56% patients between 13-20 years and 32% patients between 21-30 years and Walker SJ et al<sup>1</sup> in a study of 248 patients has mean age 18 years and 38%



patients were between 21-30 years. Male to female ratio in the present study was 1.6:1. The incidence of acute appendicitis is variable in both sexes. In one study<sup>10</sup> male to female ratio was 2.2:1.2. In the present study the mean age of 23 years and male predominance of 1.6:1 is similar to other studies.<sup>11, 24</sup> Walker SJ et al<sup>1</sup> in a series of 248 patients has 1.3:1 ratio. It can be seen from the given statistics, that there are no set patterns for incidence of the disease in both sexes and it is highly variable. The exact cause of male preponderance in most studies is not known.

Pain was the most important presenting symptom and was present in all the patients of our study. This is similar to the study of Adesunkanmi AR<sup>8</sup>, who reported lower abdominal pain in all cases of appendicitis. In our study, majority of the patients (52%) started pain in right iliac fossa. And in 48% patients, pain started in the umbilical or epigastric region and latter migrates to right iliac fossa. In the literature, the migration or shifting of pain to right iliac fossa is variable and is found in 30-64% of the patients.<sup>10</sup> In our study it was noted in 42% patients. Lee LS et al<sup>12</sup> in a large series of 766 patients emphasized migratory pain with positive predictive value of 91% which was more than leucocytes, CT scan and Ultrasonography. Another study showed that there was no difference in the frequency of migration among patients with or without appendicitis.<sup>13</sup> So when migration or shifting to right iliac fossa is present, appendicitis is likely, while absence of migration does not indicate a normal appendix. In our study duration of pain was less than 24 hours in 71% patients at the time of presentation and 21% cases had previous history of similar attacks of pain in right iliac fossa. This is different with other published series which mention 14.1%<sup>13</sup> and 20%<sup>1</sup> patients who revealed previous history of similar attacks. Anorexia, was the other most common symptom after pain in this study. It was found in 87% of the patients. This figure more or less compares with the literature. According to two studies,<sup>2,8</sup> anorexia was present in 82% and 77.7% patients respectively. In one

textbook it is the characteristic of acute appendicitis, positive in more than 90% cases.<sup>5</sup> It seems a reliable symptom and one should deeply inquire about this symptom. Anorexia was also present in 53.3% of cases with normal appendix.<sup>2</sup> In our study 94% patients experienced nausea and 72% had vomiting, once or twice usually in the early part of disease. This complaint always followed the pain. Review of literature shows that 51-69% of patients with appendicitis vomit.<sup>2,10</sup> It seems that this symptom has high sensitivity rate but less specificity, as quite a large group of patients (30-50%) with normal appendix also has this symptom.<sup>2</sup> In comparative study by Ishtiaq AC et al<sup>14</sup>, right lower quadrant pain was present in more than 95% of cases and in more than 65% of cases, there was history of nausea, vomiting and anorexia. Anorexia, nausea and vomiting are found in 93-96% of cases of appendicitis. If none of these three symptoms are present, the diagnosis should be seriously questioned.<sup>14</sup> The other common presenting symptom among majority of patients was of low-grade fever. In a few patients there was high-grade fever upto 101°F and these were the cases with perforated and gangrenous appendicitis (25%). On admission low-grade fever was noticed in 67% of the patients. This is correlated with a study that showed mean temperature more than 100.4 °F in case of perforated and gangrenous appendicitis.<sup>2</sup> Constipation was present in 52% cases, though constipation is not a common presenting symptom of acute appendicitis and is found in 4-18% of cases in some studies. The probable reason for constipation is late presentation of patients with presence of anorexia for three to four days and less intake of food. Diarrhea was found in 8% of patients in our study which is similar to a study by Rasmussen and Hoffman<sup>15</sup>, who reported that diarrhoea was found in about 7% of the patients with simple acute appendicitis. Urological symptoms, commonly dysuria and burning micturation were found in 22% of the cases in our study. Most of these patients were female. The probable cause of this was dehydration and in few pyuria and microscopic

haematuria might have been the cause. In simple acute appendicitis urinary symptoms were found in 3 to 11% of cases. Pain on coughing was present in 88% patients in this study, while Ishtiaq AC et al<sup>14</sup> concluded that it is a reliable sign and was present in all patients with positive appendicitis.

Tenderness was present in all patients. The degree of tenderness was different in each individual patient, but in obese patients and in older age groups tenderness was elicited on deep palpation. These patients had relatively mild tenderness. Degree of tenderness also depends on difference in sensitivity to pain in different individuals. Incidence of tenderness in our study compares well with other series where tenderness could be elicited in 96-100% patients with appendicitis.<sup>8, 10</sup> After a review of different studies, it has been concluded that the importance of right iliac fossa tenderness is, that in the absence of tenderness acute appendicitis is unlikely.<sup>15</sup> Muscle guarding and involuntary rigidity were noted in 73% cases. This sign was 100% present in perforated and gangrenous appendix. This sign is more valuable when present because only 5-37% of cases without acute appendicitis present with guarding or involuntary rigidity.<sup>15</sup> A study by Adesunkanmi AR (1993)<sup>8</sup>, muscle guarding was present in 81% cases. In our study rebound tenderness was found in 72% cases and was helpful in diagnosis. It was more marked and persistent in cases of perforated and gangrenous acute appendicitis. It was also present in three out of 13 cases of normal appendices. In 2 different studies,<sup>2, 8</sup> rebound tenderness was present in 70% and 77.5% of all cases which is quite similar to our study. According to Alshehri MY et al<sup>16</sup> rebound tenderness was present in 94.7% cases of acute appendicitis and rebound tenderness and muscle guarding has more than 77% specificity in cases of acute appendicitis.<sup>3</sup> The Roving sign and Psoas test in our study were found to be positive in higher number of cases (>50) as compared to studies on acute appendicitis in other countries.

The total leucocyte count is widely used to aid the diagnosis of acute appendicitis. Its di-

agnostic value vary from useful to misleading. The total leucocyte count alone is not diagnostic because it has low specificity. Various studies have reported that 80% to 85% patients with acute appendicitis will have a total white cell count of over 10,000/mm<sup>3</sup>. Neutrophilia of more than 75% occurred in 78% patients<sup>15, 17</sup> When the white cell count and neutrophil counts are considered together, less than 4% of patients will have normal values.<sup>17</sup> However the present study shows that only 61.3% cases had TLC>10,000/mm<sup>3</sup> which is almost similar to the findings of a series that reported a raised TLC>10,000/mm<sup>3</sup> in only 49% of 354 patients.<sup>18</sup> A raised TLC is regarded as a sensitive test for acute appendicitis but is not diagnostic because of its relatively low specificity and does not add much to the management in patients with undoubtful clinical findings.<sup>18</sup> The sensitivity (80%) and specificity (67%) of the raised white cell count in the present study correlated with a study which showed sensitivity 88.7% and 70% specificity.<sup>18</sup> In a series of 233 patients of acute appendicitis, sensitivity & specificity of combined leucocyte count and neutrophilia was 95.7% & 61.5%.<sup>15</sup> Thus although raised white cell count may be highly sensitive test for acute appendicitis, it has low specificity and has little diagnostic value. Even a perforated appendix may be associated with a normal white cell count.<sup>15</sup>

In the present study 10 patients (6.3%) with gangrenous or perforated appendix had a TLC of less than 10,000/mm<sup>3</sup>. So in those cases where the white cell count varies with clinical signs, the clinical judgment should be considered more reliable. In the present study, urine microscopy revealed haematuria and pyuria in 35 (22%) patients and amongst these 12 (7.5%) had acute appendicitis. The effect of acute appendicitis on right kidney and urine analysis has been investigated by Puskar et al<sup>19</sup> who reported an abnormal urine microscopy in 48% of their 84 patients with acute appendicitis.<sup>33</sup> The authors concluded that inflammation is the major cause of abnormal urine analysis and transient pelvicalyceal dilatation in some patients with acute appendicitis. They

further emphasized that erythrocyturia, pyuria and proteinuria can be found in patients with acute appendicitis, but should not mislead the surgeons in the diagnosis of acute appendicitis. Fragoso and associates reported 6% of their 200 cases presenting with urinary symptoms and found some alteration in urine analysis in 45% of their cases.<sup>20</sup>

The negative exploration rate of 8.1% in the present study is consistent with the figure of 5.4-30% mentioned in various studies.<sup>1, 2, 10, 12</sup> This may be due to the fact that preoperative clinical judgment and the decision to operate was made by the senior surgeons. In operated cases the diagnostic accuracy of 92% is also consistent with the figure of 59-97% mentioned in the literature.<sup>15, 17, 20</sup> Normal appendectomy rate is higher in females (61.5%) than males (38.4%). In a study by Anderson et al<sup>16</sup> the rate of normal appendix being removed was twice (24%) higher in women than in men 12%.

In the present study 65% cases had appendix in retrocecal position. 16% cases were having pelvic and 2% subhepatic. Position of

appendix remained uncertain in a large group of cases. This uncertainty of position may be due to non-genuine manipulation to deliver the appendix. These figures do not correlate with the literature which shows 72% of appendix lies in retrocecal position,<sup>9</sup> which is considered to be the most common location of appendix. During operation on basis of naked eye appearance and later confirmed by histopathology, out of 160 cases incidence of uncomplicated acute appendicitis was 107 (66.9%), gangrenous in 22 (13.8%), perforated in 18 (11.3%) and normal in 13 (8.1%) patients. Table-III shows comparison of pathological diagnosis in different series. Pre operative delay period, which is divided into preadmission delay (by patient) and post admission delay (by surgeon) effects on the course and out come of acute appendicitis and is the main cause of perforation and complications in acute appendicitis.<sup>21</sup>

In the present study 24 (15%) cases had postoperative complications and local wound sepsis was the most common among them,

Table-III: Comparative study of different series regarding pathological diagnosis

<i>Series</i>	<i>Country</i>	<i>Number of cases</i>	<i>Normal appendix</i>	<i>Uncomplicated appendicitis</i>	<i>Complicated appendicitis</i>
Amir M, Shami IH, <sup>2</sup> 1992	Pakistan	210	7.2% (75% Female)	79.5% (167 patients)	13.3% (28 patients)
Ijaz Ahmad, <sup>21</sup> 1993	Pakistan	1156	13.7% (89% Female)	65.8% (761 patients)	20.5% (237 patients)
Walker SJ et al, <sup>1</sup> 1995	UK	248	24.3% (67% Female)	58.5% -	17.2% -
Hale DA et al <sup>24</sup> 1997	USA	4950	13% (9 Female)	66% -	21% -
Lee LS et al, <sup>12</sup> 2001	USA	766	15.7%	69.7%	14.6%
David R et al <sup>22</sup> 2001	USA	280	15.5%	58.7%	25.8%
Nazir A et al <sup>9</sup> 2002	Pakistan	100	11% (All Female)	69%	20%
Paajanen H et al <sup>23</sup> 2002	Denmark	80	21%	34%	45%
Present Study, 2003	Pakistan	160	8.1% (61.5% Female)	66.9% (107 patients)	25% (40 patients)

especially in perforated, gangrenous appendix and with diffuse peritonitis. complications range from the stitch abscesses to deep infections. It is more in complicated appendicitis. In a study by Amir and Shami<sup>2</sup> the most common cause of morbidity was wound sepsis, present in 3.5% of non perforated group and 14.3% in perforated appendicitis. Adesunkanmi AR<sup>8</sup> observed infection of surgical wounds in 20.4% cases. In the present study, mortality was zero, whereas it is reported to be 0.24% by Ijaz A.<sup>21</sup>

## CONCLUSIONS

The diagnosis of acute appendicitis can be made confidently with proper history and thorough physical examination. The total leucocyte count, urine microscopy and sometimes ultrasonography should be used in diagnosis of right iliac fossa pain, as a diagnostic aid in doubtful cases in association with physical findings but it doesn't replace the clinical skills of General Surgeons. A normal leucocyte count or abnormal urine microscopy should prompt a review of the physical findings, but the later should always take precedence.

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