

To Assess The Efficacy of Radiological Findings In Acute Appendicitis.

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Abstract: There has been a remarkable change in the diagnosis protocol of acute appendicitis (AA) with the use of ultramodality imaging techniques. In few developing countries like India where there are few skilled radiologist and even rarely accessible technologies, X-ray becomes a crucial investigation as a paramedic can operate it. This study was undertaken to find out the efficacy of X-ray in diagnosing AA. This is a prospective study, carried out at a tertiary health centre from April 2017 to October 2018. The study was approved by the Institute Ethics Committee. Written and informed consent was obtained from all patients before enrolment into the study. 100 patients were enrolled in the study fulfilling the inclusion criteria and were subjected to a detailed clinical history and relevant investigations operative X-ray abdomen erect was taken and findings were noted which were later correlated with histopathological diagnosis. Maximum patients were in the age group of 21-30 years. 66% were males. Pain in right iliac and nausea/vomiting were present in more than 70% patients. On the basis of Alvarado scoring, almost 54 % had high probability of this disease. Most common finding in X-ray abdomen erect was haze in right lower quadrant followed by blurring of pro-peritoneal fat line, which was followed by obliteration of psoas shadow and scoliosis of lumbar spine. A finding which could not be appreciated in any of the X-rays was right lower quadrant mass indenting the caecum. Gas under diaphragm was found only in 2 cases where as fecolith was found only in 3 cases. Faecolith was found in both the cases with gas under diaphragm making it significant finding in later stages which warrants immediate surgery. Almost 93% had 2 or more X-ray findings suggestive of AA, proving its relevance in diagnosis of AA. Though X-ray findings are not pathognomic of AA. But collection of them helps in the diagnosis. Compilation of patients symptoms, clinical signs (Alvarado score) and radiological findings helps in predicting the disease.

Keywords: Acute appendicitis, RIF – Right iliac fossa, USG – Ultrasonography, VA – Vermiform Appendix, GALT - Gut-associated lymphoid tissue.

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I. Introduction

Most patients presenting with excruciating pain in abdomen have acute appendicitis (AA) making it surgically important. It is one of main causes of acute abdomen which tests clinical acuity of clinicians. It is ubiquitous and is increasing in countries which are developing¹. 'Males are more vulnerable to this disease with lifetime risk of 8.6% whereas it is 6.7% for females'^{2,3}. Complications include perforation, intra-abdominal abscesses, wound infection, septicaemia and death, which make it a dreaded disease if not treated on time. The chances of perforation in this disease increases with lag in diagnosis and treatment. Rate of negative appendectomies is high⁴. The risk of poor outcome and elongated stay in hospital due to perforation which occurred due to delay in the diagnosis is 10% to 15 % whereas rate of unfavourable appendectomy is 26% making this disease a double edged sword⁵. Negative appendectomy leads to financial, mental and social burden on patient as well as the society⁶. A collection of patients complaints, presentation, investigations and laboratory results balances pre-operative delay risk with the excision of a normal appendix. Final diagnosis is made on table by visualizing the appendix and later by histopathological examination.⁷ Routine laboratory blood examination may be non-specific.

The diagnostic accuracy in suspected appendicitis has significantly improved due to Ultrasonography (USG) with an overall accuracy of 85 -96%⁸. It is operator dependent with lower diagnostic rates with inexperienced radiologist. Today, X-ray of abdomen is rarely done in AA which was previously mandatory. But advantage of X-ray over other radiological investigation is that it is easily available, cost effective, portable, paraclinical with no specialist required and requires minimal patient preparation. In this study we evaluate validity of radiological investigation in AA and its impact on diagnosis.

II. Methods

Type of Study: Prospective

Place of Study: MGM Medical College and Hospital, NaviMumbai.

Period of study: May 2017 to September 2018. The study was approved by the Institute Ethics Committee. Written and informed consent was obtained from all patients before enrollment into the study,

Sample size: 100 patients

Plan of Study:

Inclusion criteria: All patients diagnosed as AA- intact or perforated appendix, Only patients undergoing surgery will be included, All age groups.

Exclusion criteria: Patients admitted for interval appendectomy following recurrent appendicitis, appendicular abscess, appendicular mass previously treated conservatively. Patients who had undergone other emergency laparotomy where appendectomy was also performed. Pregnant females. The profile of all the patients was recorded under following headings: Demographic: Age, sex, address, Chief complaints, Clinical findings, Blood counts, Modified Alvarado Score.

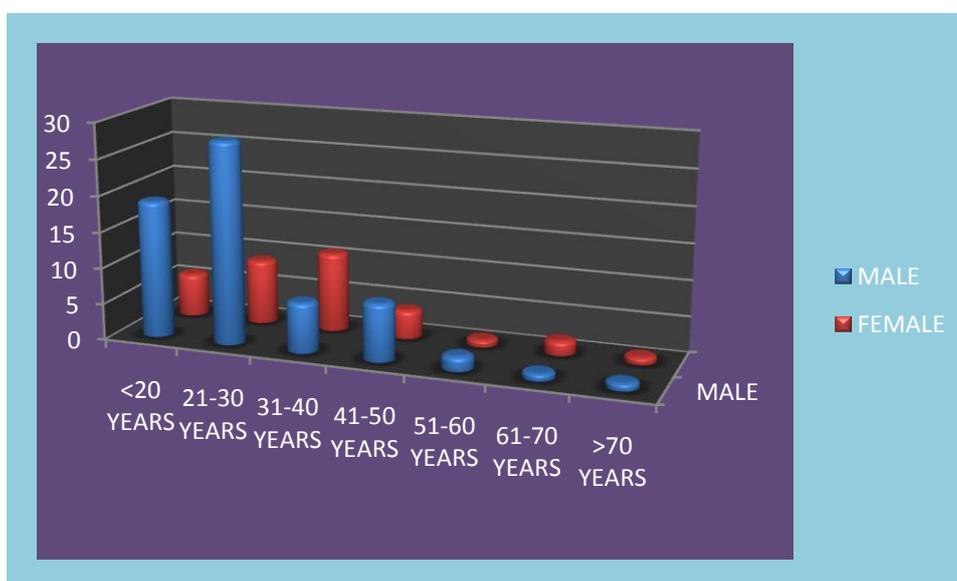
III. Results

Interpretation:

Age and Gender Distribution

Table 7: Age and Gender Distribution

Age group	Male	Female	Total
<20	19	6	25
21-30	28	9	37
31-40	7	11	18
41-50	8	4	12
51-60	2	1	3
61-70	1	2	3
>70	1	1	2
Total	66	34	100



Graph 1: Age & gender Distribution

The maximum male patients were in age group 21-30 and females in 31-40. The study included 66 males and 34 females.

TABLE 8: Mean age according to sex.

TABLE

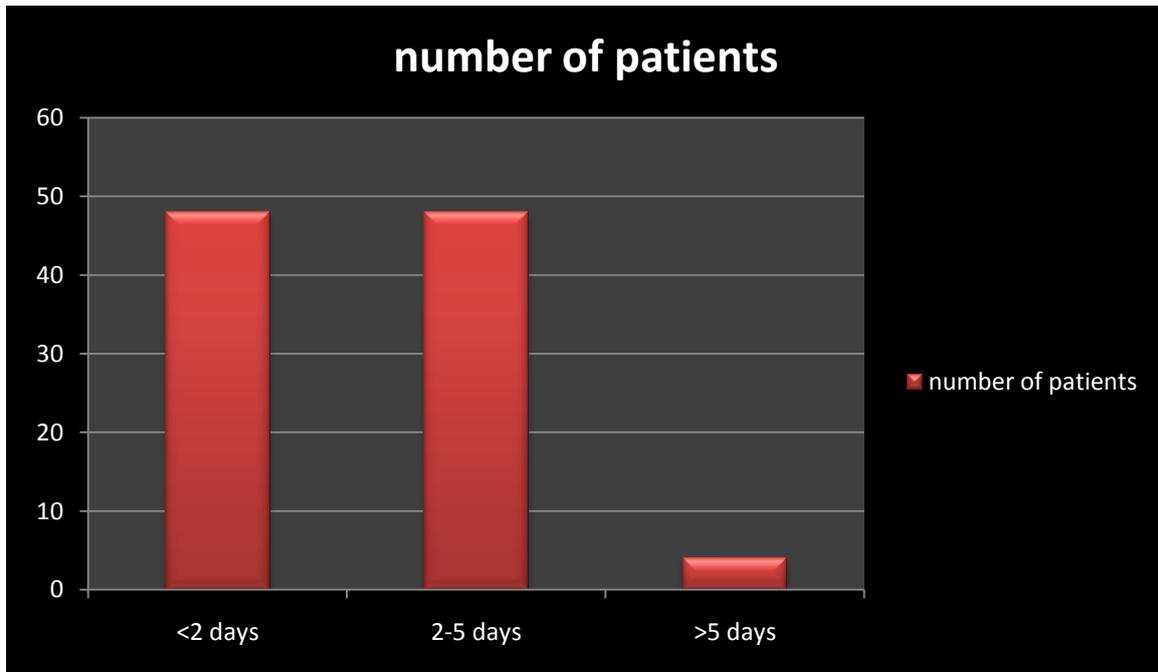
MEAN AGE(YRS)	MALE		FEMALE		p value
	Mean	SD	Mean	SD	
	28.0	14.3	34.1	15.2	

Note: * significant at 5% level of significance (p<0.05)

These tables show the distribution of age & sexes. Males were predominant (66%) and Females were 34%. Majority of patients were from 21-30 years age group followed by 31-40 years age group. Mean age among males was significantly higher than among females.

Table 9: Duration of symptoms.

	No of patients	Percentage
<2 days	48	48%
2-5 days	48	48%
>5 days	4	4%

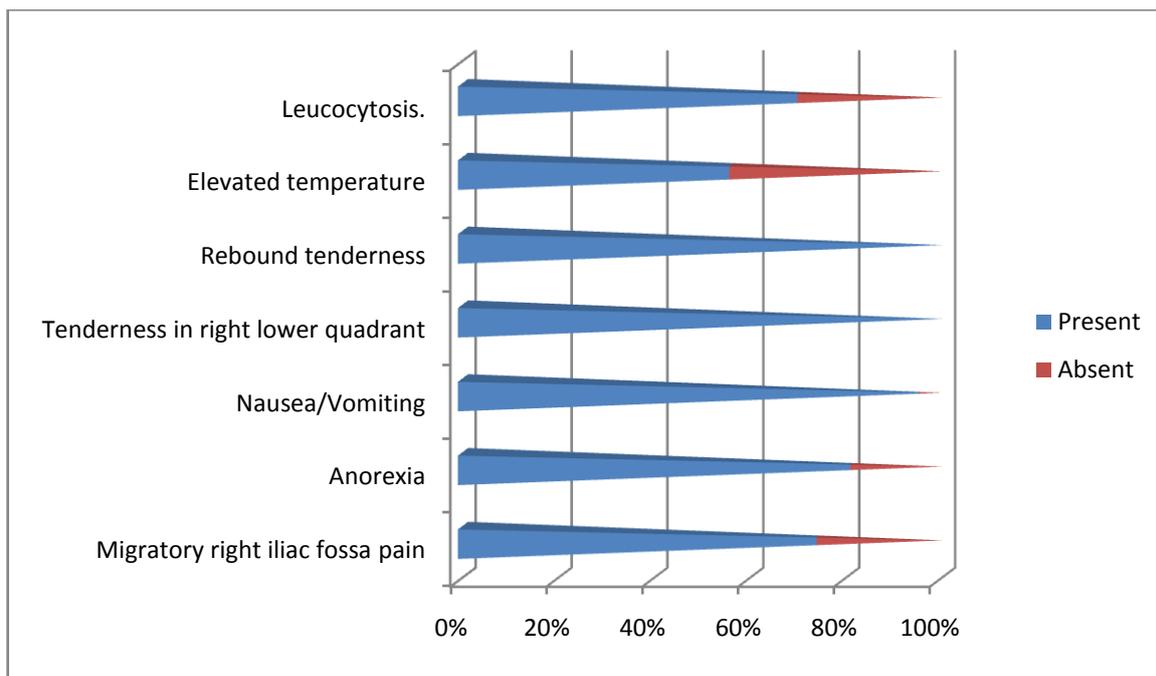


Graph 2: Duration of symptoms.

The patients most commonly presented within the first 5 days of the symptoms

Table 10: Components of Modified Alvarado score.

		Number of Cases	Percentage
Migratory Right Iliac Fossa pain	Present	74	74.0%
Anorexia	Present	81	81.0%
Nausea/Vomiting	Present	95	95.0%
Tenderness in right lower quadrant(2)	Present	100	100.0%
Rebound tenderness in Right lower quadrant	Present	100	100.0%
Elevated temperature	Present	56	56.0%
Leucocytosis(2)	Present	70	70.0%

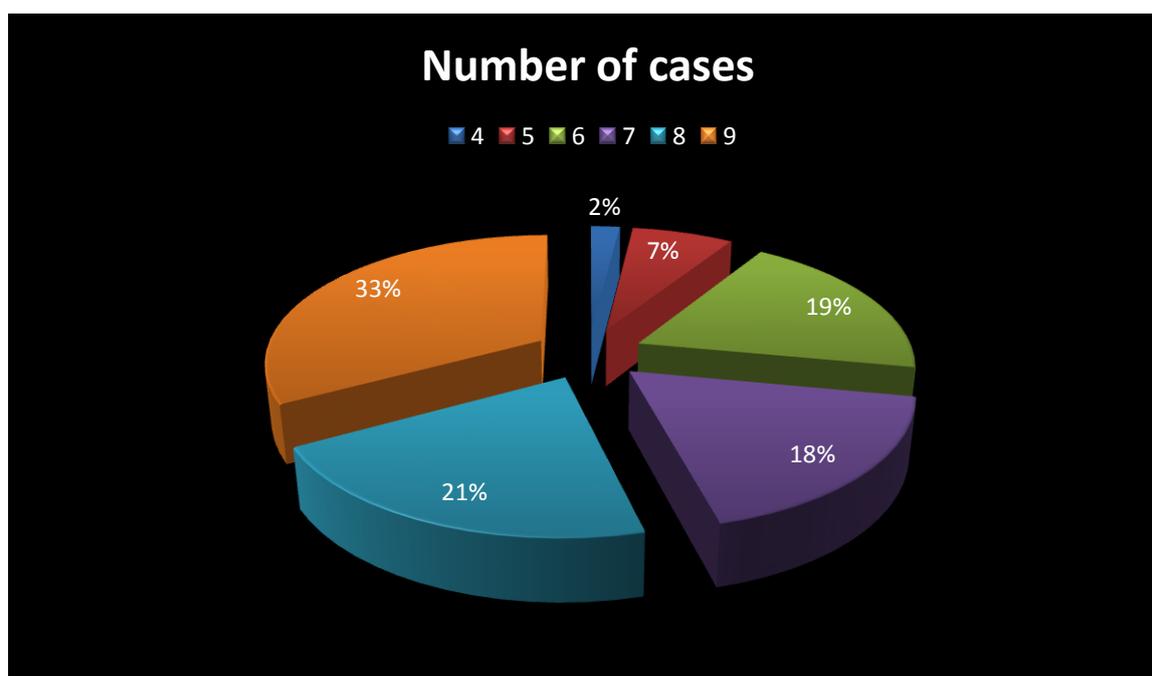


Graph 3: Components of Modified Alvarado score.

Tenderness and rebound tenderness in right iliac fossa were present in all. Next common symptom being nausea/vomiting.

Table 11: Total Modified Alvarado score

Total Score	Number of Cases	Percentage
4.00	2	2.0%
5.00	7	7.0%
6.00	19	19.0%
7.00	18	18.0%
8.00	21	21.0%
9.00	33	33.0%



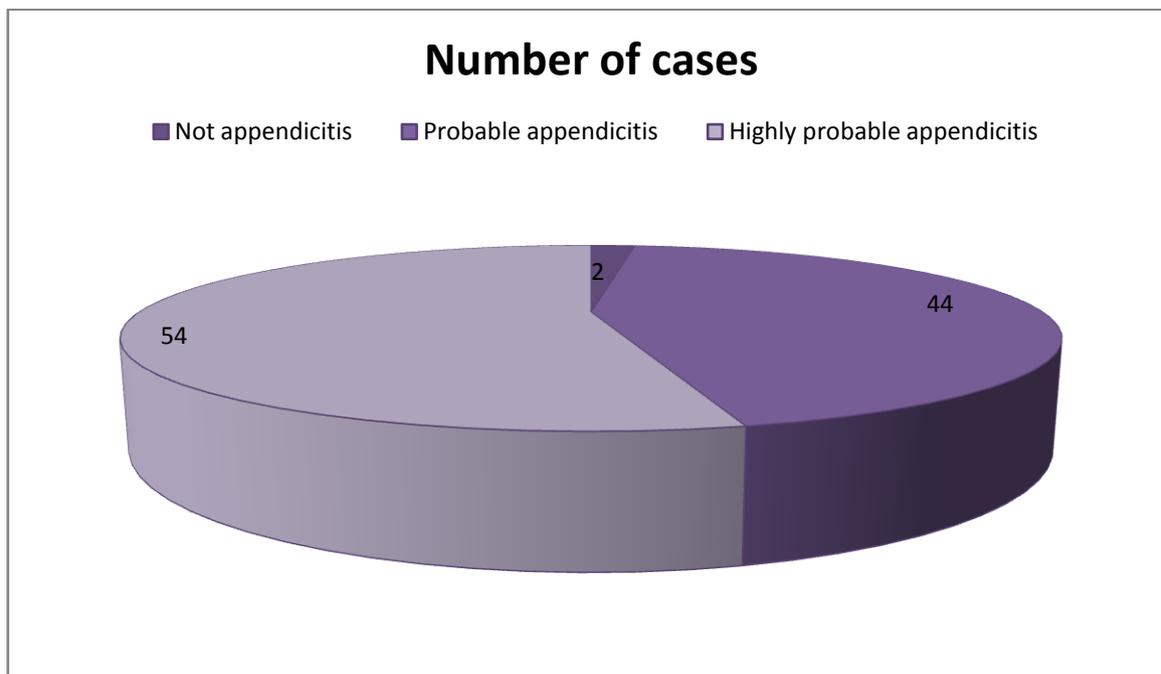
Graph 4: Total Modified Alvarado score.

Total Alvarado score ranged from 4-9.

Total score of 9 present in 33% patients while 2% had a score of 4.

Table 12 : Probability of AA on the basis of Modified Alvarado score.

		Number of Cases	Percentage
TS	Not appendicitis	2	2.0%
	Probable appendicitis	44	44.0%
	Highly probable appendicitis	54	54.0%

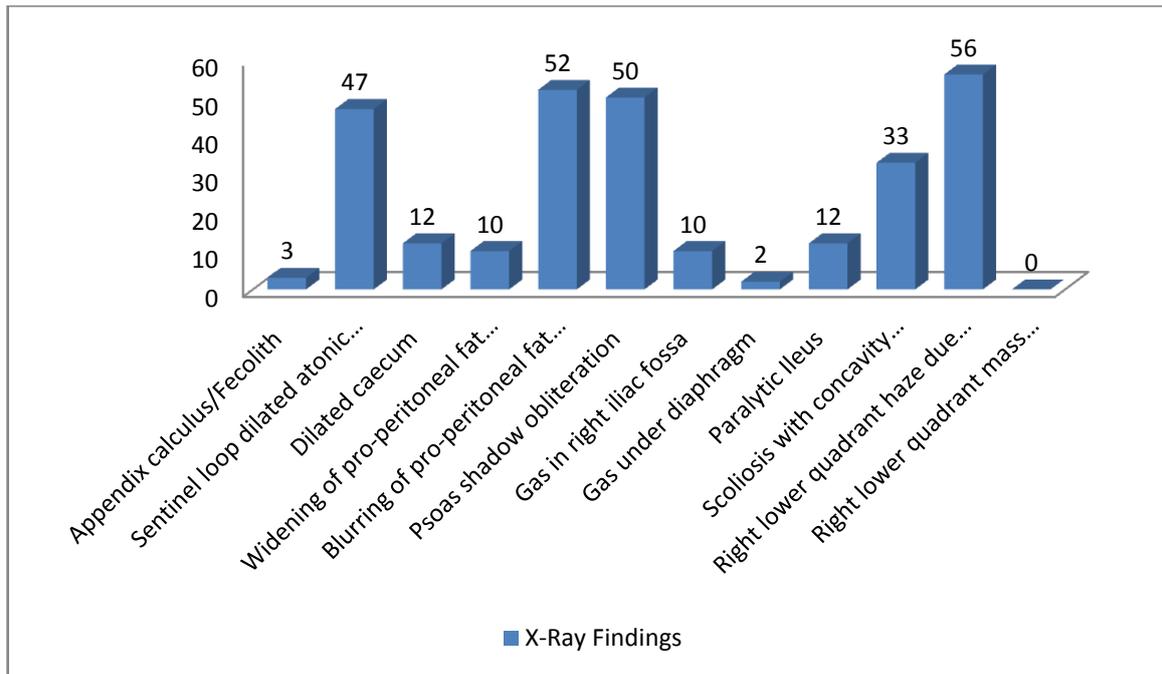


Graph 5: Probability of AA on the basis of Modified Alvarado score.

54% cases had a high probability of

Table 13 : X-ray findings.

		Number of Cases	Percentage
Appendix calculus/Fecolith	Present	3	3.0%
Sentinel loop dilated atonic ileum with air fluid level	Present	47	47.0%
Dilated caecum	Present	12	12.0%
Widening of pro-peritoneal fat line	Present	10	10.0%
Blurring of pro-peritoneal fat line	Present	52	52.0%
Psoas shadow obliteration	Present	50	50.0%
Gas in right iliac fossa	Present	10	10.0%
Gas under diaphragm	Present	2	2.0%
Paralytic Ileus	Present	12	12.0%
Scoliosis with concavity towards right	Present	33	33.0%
Right lower quadrant haze due to fluid and edema	Present	56	56.0%
Right lower quadrant mass indenting the caecum	Present	0	0.0%

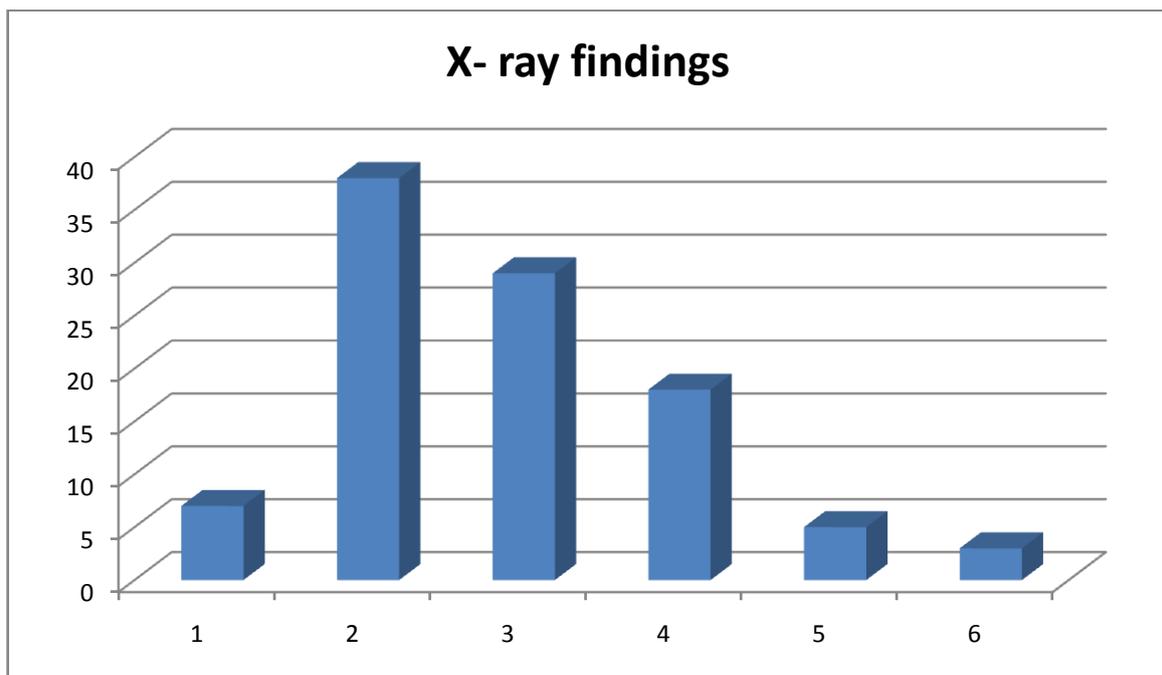


Graph 6: X-ray findings.

Most common finding was right lower quadrant haze due to fluid and edema followed by blurring of peritoneal fat line. Right lower quadrant mass was not found in any of the X-rays.

Table 14: Number of X-ray findings in each case.

X- ray findings	Number of cases
1	7
2	38
3	29
4	18
5	5
6	3



Graph 7: X-ray findings in each case.

Maximum of 6 findings and minimum 1 finding was present in each case.

Most of the X-rays had 2-4 findings suggestive of AA.

Sensitivity=93.00% (86.11% to 97.14%- confidence interval 95%)

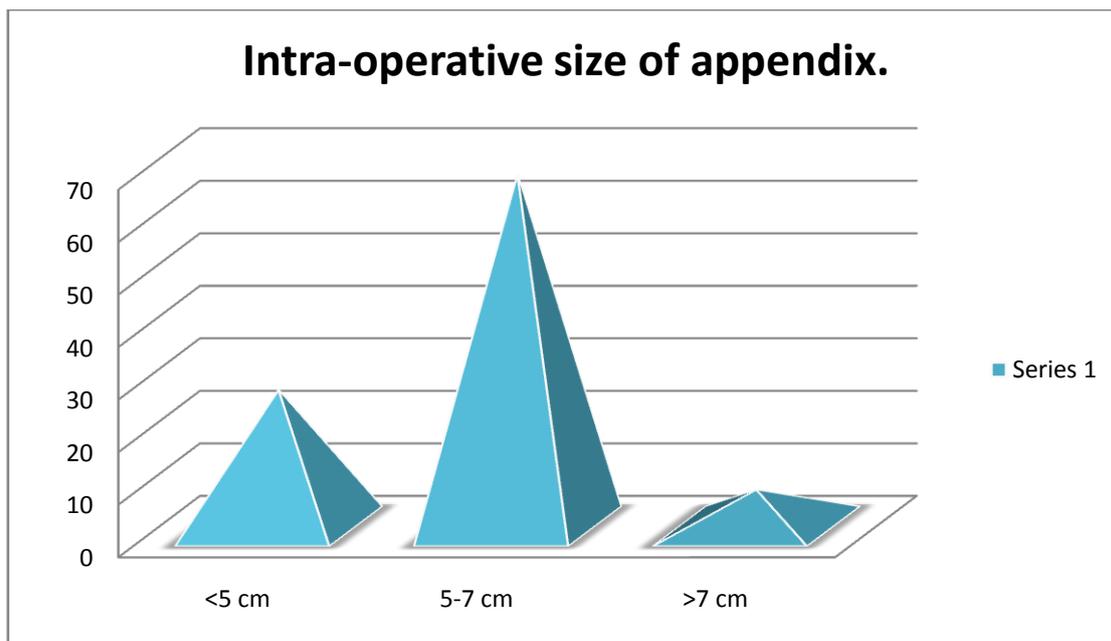
Disease prevalence=100.00% (*) (96.38% to 100.00%- confidence interval 95%)

Accuracy=93.00% (*) (86.11% to 97.14%- confidence interval 95%)

Only 7 cases had less than 2 findings suggesting an important role of this investigation in diagnosis of AA.

15: Intra-operative size of appendix.

Appendix size	No of patients	Percentage%
<5 cm	26	26
5-7 cm	67	67
>7 cm	7	7

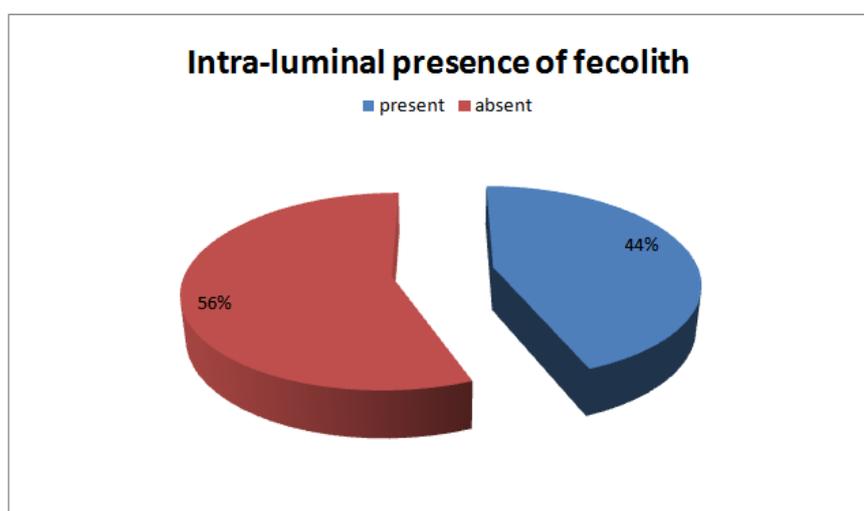


Graph 8: Intra-operative size of appendix.

Maximum patients had appendix between 5-7 cm.

Table 16 : Intra-luminal presence of fecolith.

Fecolith	No of patients	Percentage%
Present	44	44
Absent	56	56

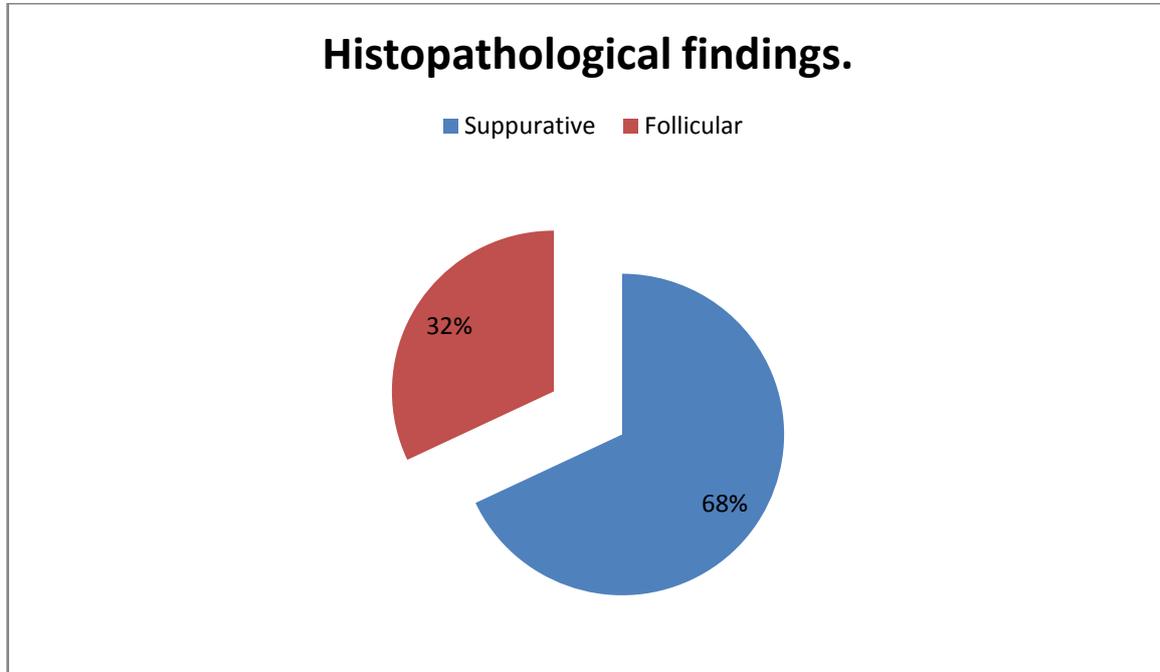


Graph 9 : Intra-luminal presence of fecolith.

56% patients did not have fecolith as the cause of AA.

Table 17: Histopathological findings

	Number of Cases	Percentage
Suppurative	68	68.0%
Follicular	32	32.0%



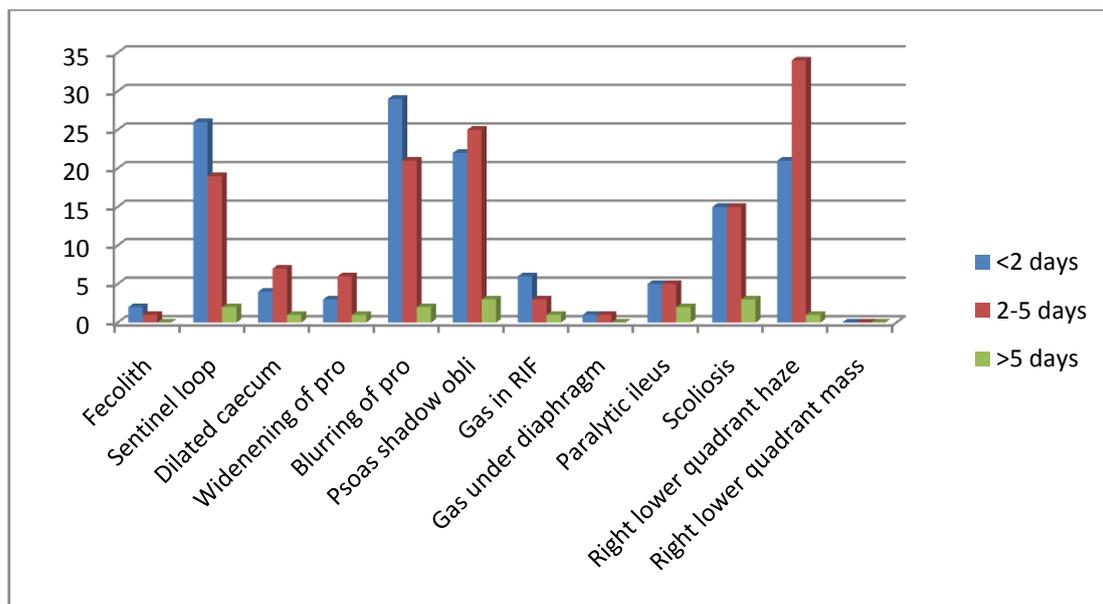
Graph 10: Histopathological findings.

Most common histopathological diagnosis is suppurative.

Table 18 : X-ray and duration of symptoms.

	<2 days	2-5 days	>5 days	total
Fecolith	2	1	0	3
Sentinel loop	26	19	2	47
Dilated caecum	4	7	1	12
Widening of pro	3	6	1	10
Blurring of pro	29	21	2	52
Psoas shadow obli	22	25	3	50
Gas in RIF	6	3	1	10
Gas under diaphragm	1	1	0	2
Paralytic ileus	5	5	2	12
Scoliosis	15	15	3	33
Right lower quadrant haze	21	34	1	56
Right lower quadrant mass	0	0	0	0

(Chi-square, $p > 0.05$)



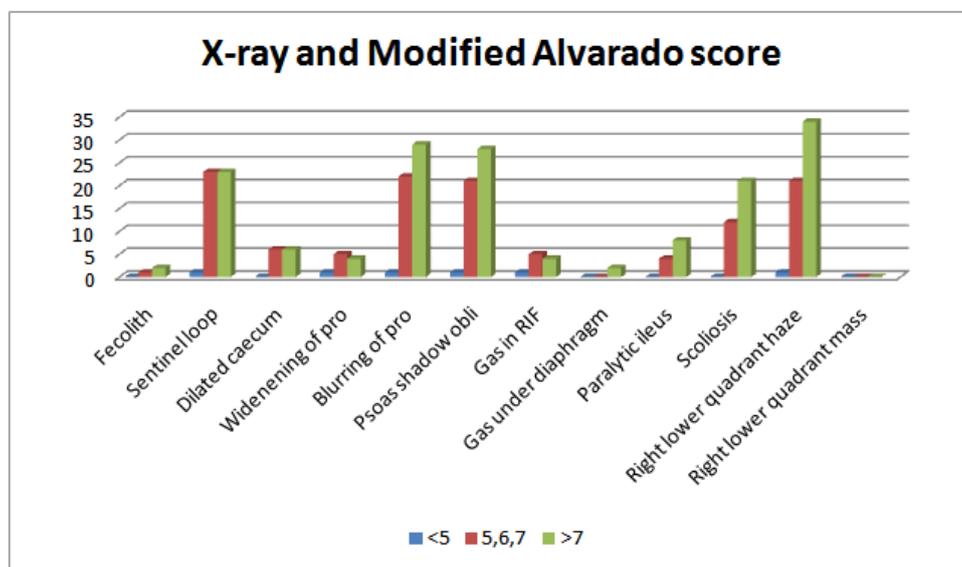
Graph 11: X-ray and duration of symptoms.

Most common finding seen in <2 days is blurring of pro-peritoneal line. 2-5 days is right lower quadrant haze and >5 days is psoas shadow obliteration with scoliosis. There was no significant association between X-ray and duration of symptoms.

Table 19 : X-ray and Modified Alvarado score.

	<5	5-7	>7	Total
Fecolith	0	1	2	3
Sentinel loop	1	23	23	47
Dilated caecum	0	6	6	12
Widening of pro	1	5	4	10
Blurring of pro	1	22	29	52
Psoas shadow obli	1	21	28	50
Gas in RIF	1	5	4	10
Gas under diaphragm	0	0	2	2
Paralytic ileus	0	4	8	12
Scoliosis	0	12	21	33
Right lower quadrant haze	1	21	34	56
Right lower quadrant mass	0	0	0	0

(Chi-square, $p > 0.05$)

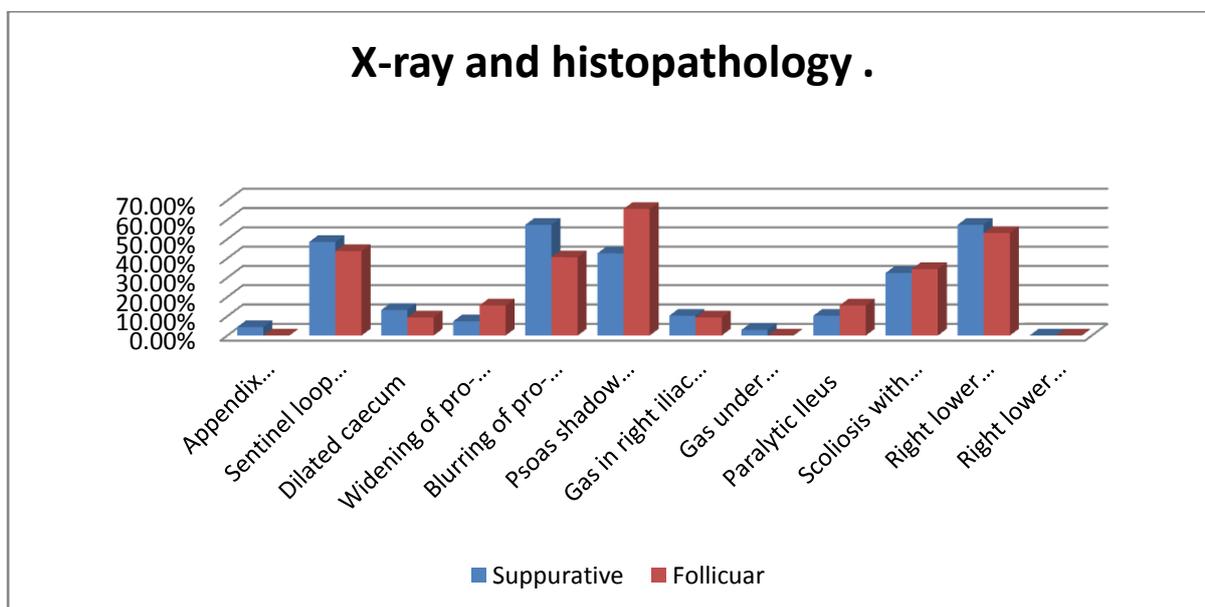


Graph 12 : X-ray and Modified Alvarado score.

Most common X-ray finding with score of <5 is sentinel dilated loop, 5-7 score is sentinel dilated loop followed by blurring of pro-peritoneal fat line and >7 is right lower quadrant haze. There is no significant association between X-ray and Modified Alvarado score.

Table 20: X-ray and histopathology.

		AA (Comparison against all xray findings)			
		Suppurative		Follicular	
		Count	Column N %	Count	Column N %
Appendix calculus/Fecolith	Present	3	4.4%	0	0.0%
	Absent	65	95.6%	32	100.0%
Sentinel loop dilated atonic ileum with air fluid level	Present	33	48.5%	14	43.8%
	Absent	35	51.5%	18	56.3%
Dilated caecum	Present	9	13.2%	3	9.4%
	Absent	59	86.8%	29	90.6%
Widening of pro-peritoneal fat line	Present	5	7.4%	5	15.6%
	Absent	63	92.6%	27	84.4%
Blurring of pro-peritoneal fat line	Present	39	57.4%	13	40.6%
	Absent	29	42.6%	19	59.4%
Psoas shadow obliteration	Present	29	42.6%	21	65.6%
	Absent	39	57.4%	11	34.4%
Gas in right iliac fossa	Present	7	10.3%	3	9.4%
	Absent	61	89.7%	29	90.6%
Gas under diaphragm	Present	2	2.9%	0	0.0%
	Absent	66	97.1%	32	100.0%
Paralytic Ileus	Present	7	10.3%	5	15.6%
	Absent	61	89.7%	27	84.4%
Scoliosis with concavity towards right	Present	22	32.4%	11	34.4%
	Absent	46	67.6%	21	65.6%
Right lower quadrant haze due to fluid and edema	Present	39	57.4%	17	53.1%
	Absent	29	42.6%	15	46.9%
Right lower quadrant mass indenting the caecum	Present	0	0.0%	0	0.0%
	Absent	68	100.0%	32	100.0%



Graph 13 :X-ray and histopathology.

Chi-Square test result:

	chi	df	p-value	Interpretation
Appendix calculus/Fecolith	1.455	1	0.228	NS
Sentinel loop dilated atonic ileum with air fluid level	0.2	1	0.655	NS
Dilated caecum	0.307	1	0.579	NS
Widening of pro-peritoneal fat line	1.654	1	0.198	NS
Blurring of pro-peritoneal fat line	2.439	1	0.118	NS
Psoas shadow obliteration	4.596	1	.032*	Significant
Gas in right iliac fossa	0.02	1	0.886	NS
Gas under diaphragm	0.96	1	0.327	NS
Paralytic Ileus	0.586	1	0.444	NS
Scoliosis with concavity towards right	0.04	1	0.841	NS

Right lower quadrant haze due to fluid and edema	0.158	1	0.691	NS
Right lower quadrant mass indenting the caecum	Not calculated as all cases in present category only			

Presence of Psoas shadow obliteration is a significant finding in diagnosis of acute suppurative appendicitis.

IV. Discussion

In this study, we scrutinized 100 patients in whom X-ray abdomen erect was done pre-operatively. Most male patients ranged from 21-30 years while female patients ranged from 31-40 years. 66% were males. 96% of the patients presented within 5 days of the symptoms out of which 48% presented within 2 days. 74% patients presented with some degree of tachycardia. Migratory right iliac fossa pain was present in more than 70% patients with the classical rebound tenderness being present in all 100 patients. Anorexia was present in 81 cases where as nausea/vomiting was present in almost 95 patients. 56 patients had elevated temperature with 70 patients having leukocytosis. Total Alvarado score ranged from 4-9 with 9 being the maximum. On the basis of Alvarado scoring, almost 54 % had high probability of this disease. Most common finding in X-ray abdomen erect was haze in right lower quadrant followed by blurring of pro-peritoneal fat line, which was followed by obliteration of psoas shadow and scoliosis of lumbar spine. A finding which could not be appreciated in any of the X-rays was right lower quadrant mass indenting the caecum. Gas under diaphragm was found only in 2 cases where as fecolith was found only in 3 cases. Fecolith was found in both the cases with gas under diaphragm making it significant finding in later stages which warrants immediate surgery. Intra-operatively, fecoliths were found in almost 44 patients but only on 3 X-rays. This means that fecolith take time to calcify and appear on X-rays. Thus, when seen on X-ray signify advanced stage which requires immediate intervention.

V. Conclusion

- Acute Appendicitis is frequent in males.
- Pain in iliac region on the right and nausea/vomiting are the common presenting features.
- Modified Alvarado score is a highly reliable tool.
- X-ray abdomen signs are not pathognomic only to appendicitis but each sign can have many differentials.
- A collection of signs on X ray helps in proper diagnosis.
- Most significant sign on x ray is right lower quadrant haze and psoas shadow obliteration. It increases as the disease progresses.
- In all cases, we had X-ray findings which were of some use to bring to the conclusion. If keenly observed, it will be of immense help.
- X-ray results in adjunct to clinical conclusion and Alvarado scoring increases the precision of conclusion.

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