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RESEARCH ARTICLE

THE SHORT TERM OUTCOME OF NON-OPERATIVE MANAGEMENT IN ACUTE UNCOMPLICATED APPENDICITIS

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ABSTRACT

The gold standard appendectomy for acute appendicitis has been questioned in the immediate past. The operative management of this condition is associated with significant financial costs and represents a significant workload on the emergency surgical services. The standard of care for many years has been surgical appendectomy; however, it carries with it risks including bleeding, wound complications, injury to surrounding structures, and the potential need for reoperation. Negative appendectomy rates remain high (20–25%) despite advancements in laboratory testing and imaging techniques. Recent data from randomized controlled trials suggests that non-operative management in patients presenting with uncomplicated or non-perforated acute appendicitis is a viable alternative, with only 23% of patients requiring an appendectomy at 1 year and an overall reduction in complications. In view of this, the traditional teaching of mandatory appendectomy for all patients with acute appendicitis should be challenged. With this background, the present study of 230 patients was designed to evaluate short term outcome of non-operative treatment in acute uncomplicated appendicitis. At the end of 2 years, 84% of patients responded successfully to the non-operative management while the percentage of recurrence was 27%.

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INTRODUCTION

Appendix is an abdominal organ arising from the midgut as out pouching of caecum at 8th week of gestation. The average size is 9cm in adults, it is supplied by appendicular artery which is a branch of ileocolic artery and lymphatics drain into anterior ileocolic nodes. Its base is located at the confluence of taeniae coli along the inferior aspect of caecum. Acute appendicitis is a very common disease with a life time risk of 7-8%, the highest incidence found in the second decade of life (Addiss *et al.,* 1990). Although the etiology of acute appendicitis is still poorly understood, the most common hypothesis refers to appendix obstruction followed by impairment of wall appendix barrier and subsequent wall perforation and/or abscess formation. Acute Appendicitis refers to a distinct entity pathologically characterized by acute transmural inflammation of appendix. Clinically it is characterized by acute onset of pain, which is initially periumbilical but later shifts to the right iliac fossa accompanied by rebound tenderness. Although it is more than 100 years since Mcburney reported his study of eight patients with acute appendicitis, the aetiology and the diagnosis of this condition still remains enigmatic.

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Symptoms of acute appendicitis overlap with a number of other conditions making diagnosis a challenge, particularly at an early stage of presentation (Bundy *et al.,* 2007). Routine detailed history and examination remains the most effective diagnostic tool for diagnosis of acute appendicitis (Peterson *et al.,* 1992). Diagnosis of acute appendicitis is based purely on clinical history and examination combined with few laboratory investigations such as elevated white cell Count. Despite being a common problem, acute appendicitis remains a difficult diagnosis to establish in some cases, particularly in young, elderlyand female patients of reproductive age where a host of other genitourinary and gynaecological inflammatory conditions can also present with similar signs and symptoms as of acute appendicitis (Gilmore *et al.,* 1975). The signs of acute appendicitis may even be difficult to appreciate in the obese patients. The idea that appendicitis can resolve without surgery is not new. In 1886, before the development of antibiotic therapy, Fitz (Fitz *et al.,* 1886) reported that many autopsy specimens showed evidence of previous appendicitis, indicating that some patients could resolve the disease without surgical intervention. In 1959, Coldrey (1959) published his case series describing non-operative treatment of acute appendicitis and concluded that many cases of appendicitis resolve without surgery. Early appendectomy for long has been

gold standard of managing appendicitis, this has been challenged recently by the publication of a series of studies by Pisano (2013), Hansson (2009), Varadhan (2010), Eriksson (2010) and others advocating the use of antibiotics as safe and efficient management avoiding unnecessary surgery. There is a growing body of research assessing the potential for non-operative therapy to be extended to uncomplicated appendicitis. Such research promotes the alignment of treatment methods for both complicated and uncomplicated appendicitis (Vons *et al.,* 2011; Hansson *et al.,* 2012). Other reports indicate that immediate appendectomy can be avoided for at least 24hr without increasing morbidity if antibiotics are administered (Andersson, 2007). Other authors suggest that appendectomy may not be necessary for the majority of patients with acute uncomplicated appendicitis, as the condition resolves spontaneously in many patients and in others may be treatable with antibiotics alone (Mason, 2008). This approach has many advantages, including high success and low recurrence rates, reduced morbidity and mortality, less pain, shorter hospitalization and sick leave, and reduced costs (Sakorafas *et al.,* 2011) and further can avoid the complications of surgery and surgical wound as depicted in Fig 1-4. In light of this, routine interval appendectomy after initial successful conservative treatment does not seem justified and should be abandoned. In fact, traditional interval appendectomy may prevent recurrent appendicitis in only 6.7% of patients after conservative treatment of acute appendicitis with an appendicular mass. Thus 93.3% would have an unnecessary appendectomy (Tekin *et al.,* 2008).

Aims and Objectives: Assess the outcomes of non-operative management in acute uncomplicated appendicitis.

MATERIALS AND METHODS

The present study was a hospital based study, prospective in design, conducted in the department of General Surgery, Government Medical College. The study sample included 230 patients clinically diagnosed as acute appendicitis fulfilling the inclusion criteria of our study. Informed consent was obtained from all patients. A complete pre-operative work up was done in all patients which included a thorough clinical history and physical examination. All patients were advised the following investigations, Haemoglobin, Total Leucocyte Count, Differential Leucocyte Count, Platelet count, Blood urea, serum creatinine, Serum electrolytes, Liver Function Tests, C Reactive Protein, Serum Fibrinogen, Ultrasound abdomen, X-Ray Abdomen erect and supine films, urine analysis, electrocardiogram and Application of Alvarado scoring in every clinically diagnosed case. All patients diagnosed as having acute uncomplicated appendicitis with low MANTREL were enrolled and admitted. Non-operative treatment is an intravenous antibiotic regimen with the following protocol: 4.5g Piperracillin Tazobactum thrice daily and 400 mg Tinidizole once daily for 3 days, followed by an oral course of third generation Cephalosporin for a period one week.Subsequent to antibiotic delivery, if symptoms did not improve within 72 hr, appendectomy was performed. Patients were interviewed using a preformed proforma for assessing pain, need for hospital readmission, and general treatment after discharge.

Inclusion criteria

1. Age >5yrs and < 70 years.
2. Lower/RIF Abdominal Pain.
3. Clinical Suspicion of Acute Appendicitis: i.e.
   Alvarado Score 5-6 (equivocal for acute appendicitis)
   Alvarado Score7-8 (probably appendicitis)
   Alvarado Score9-10(highly likely appendicitis)
4. Informed consent (patient or legal representative)

Exclusion criteria

1. Previous appendectomy.
2. Peritonitis.
3. Refusal of consent.

Fig. 1. Post Appendectomy Incisional Hernia

Fig. 2. Post Appendectomy Wound Infection

Fig. 3. Post Appendectomy Fistula

Fig. 4. Post Appendectomy Adhesion Obstruction

Fig. 5. Usg Showing Target Appearance In Acute Appendicitis

Fig. 6. Usg Showing Blind Ended Tubular Structure In Acute Appendicitis

OBSERVATIONS AND RESULTS

Age distribution of patients

Out of the total 230 subjects included in our study, acute appendicitis was found most common in the age group of 11-20.The mean age of the patients was 23.3+- 4 years.

Age Group (in years)	Number of Patients	Percentage
0-10	28	13%
11-20	76	33%
21-30	68	30%
31-40	34	15%
41-50	15	06%
51-60	06	02%
61-70	03	01%
Total	230	100%

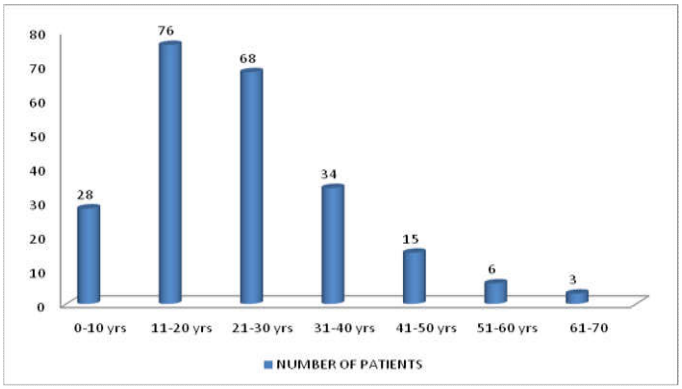


Figure 1. Age Distribution

Sex distribution of patients

In our study, the number of female patients was more than males. Males Comprised of 49% of the total subjects while females comprised of 51% of total subjects.

Sex	No of Patients	Percentage
Male	113	49%
Female	117	51%
Total	230	100%

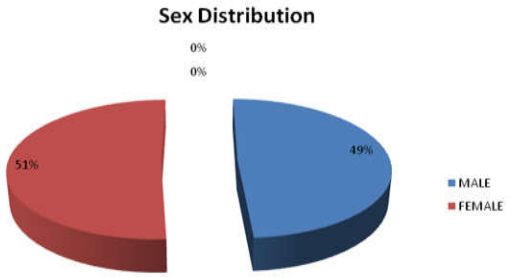


Figure 2. Sex Distribution

Hospital stay

The hospital stay of patients ranged from 1 to 7 days, with the median hospital stay of 3 days.

Hospital stay in days	Number of patients
01	17
02	58
03	69
04	50
05	24
06	5
07	7

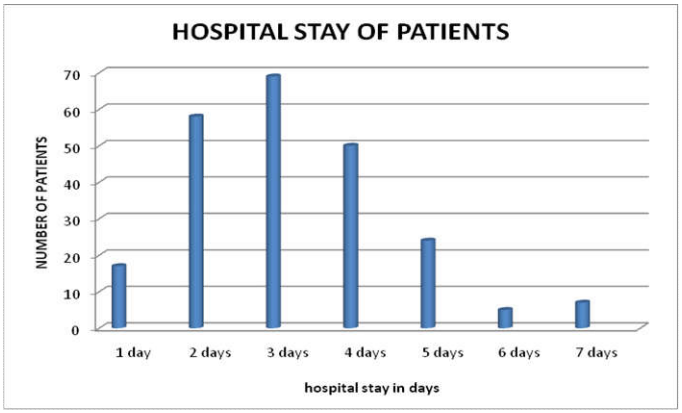


Figure 3. Hospital Stay in Days

Usg findings in patients vs. TLC counts

Total leucocyte count was raised more than 10000/cm^3 in 39.5% patients (91/230). 54% (49/91) patients with raised total leucocyte counts were having USG findings suggestive of acute appendicitis (Fig 5-6), while 39% (54/139) patients with total leucocyte count less than 10000/cm^3 had USG findings suggestive of acute appendicitis. p value being 0.02.

TLC Count/cm^3	Positive USG	Negative USG	total
>10000/cm^3	49(54%)	42(46%)	91
<10000/cm^3	54(39%)	85(61%)	139
Total			230

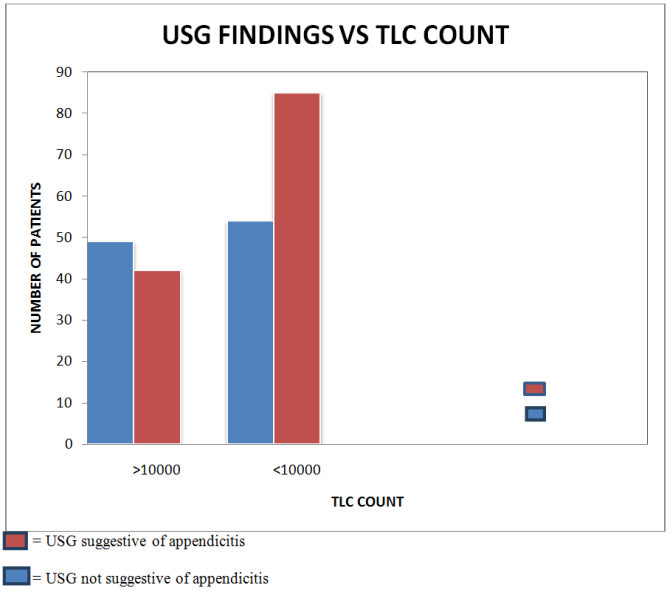


Figure 4. USG Findings in Patients VS TLC Counts

USG findings in patients vs bilirubin levels

30% (69/230) patients had serum bilirubin >1mg/dl, 71% patients with serum bilirubin >1mg/dl had USG findings suggestive of acute appendicitis while 29% patients with serum bilirubin<1mg/dl had USG findings suggestive of acute appendicitis. p value being 0.0000001

Serum bilirubin	Positive USG	Negative USG	Total
>1mg/dl	49(71%)	20(29%)	69
<1mg/dl	48(29%)	113(71%)	161
total			230

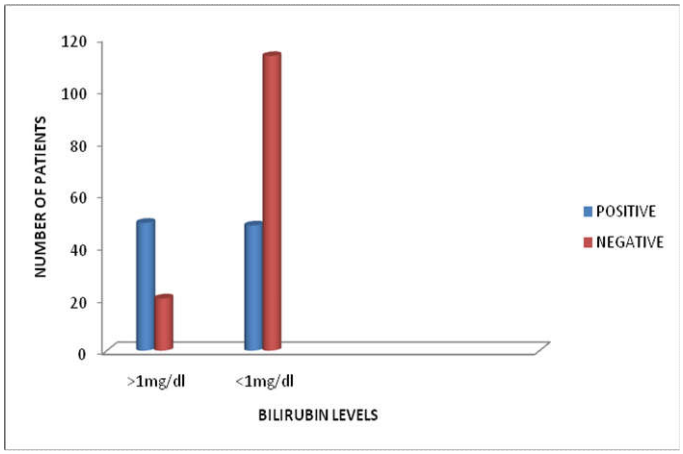


Figure: 5 USG Findings in Patients VS Serum Bilirubin

CUB-Mantrel scores in patients

CUB-MANTREL scores ranged from score of 3 to 12, the score of 7 being the most common seen in 64 patients out of 230 patients corresponding to a percentage of 27.8%.

Cub-Mantrel Score	Number of patients	Percentage Of patients
3	6	2.6%
4	2	0.8%
5	26	11.3%
6	40	17.3%
7	64	27.8%
8	50	21.7%
9	26	11.3%
10	8	3.4%
11	2	0.8%
12	6	2.6%
TOTAL	230	100%

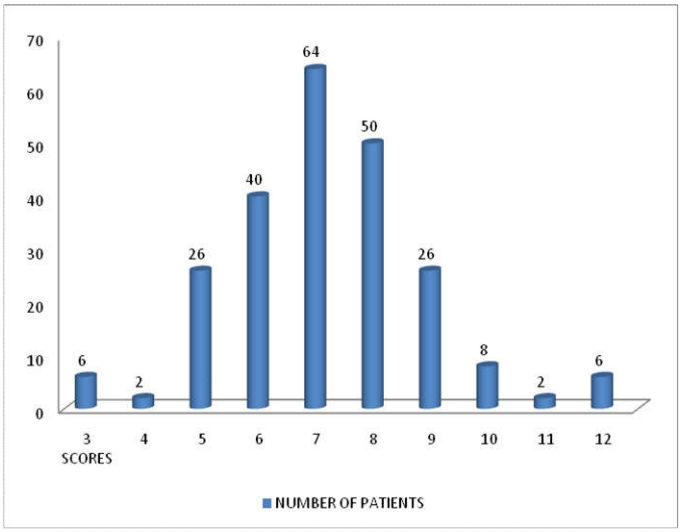


Figure 7. CUB-MANTREL Scores in Patients

Outcome at one year

At the end of one year, out of 120 patients entitled in the study, in 101 patients non-operative management was successful with a percentage of 85%. 19 patients didn't respond to non-operative treatment and surgical intervention was required with a percentage of 15%. Out of 101 patients managed successfully by non-operative treatment, 25 patients had recurrences, out of which 4 were later operated.

Outcome of non-operative treatment	Number of patients	Percentage
Successful	101	85%
Failure	19	15%
Total	120	100%
Recurrences	25/101	24%

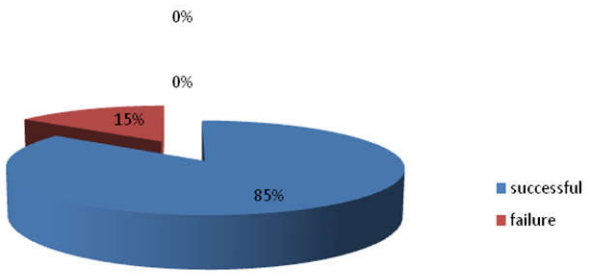
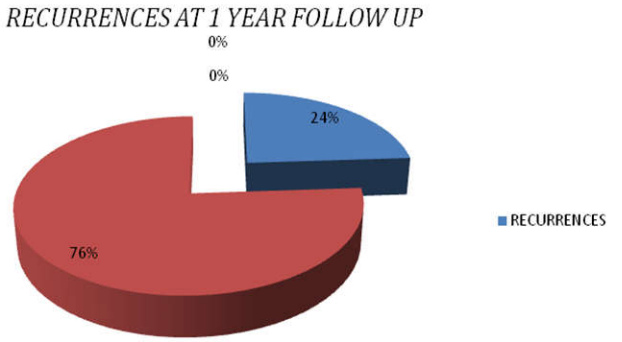


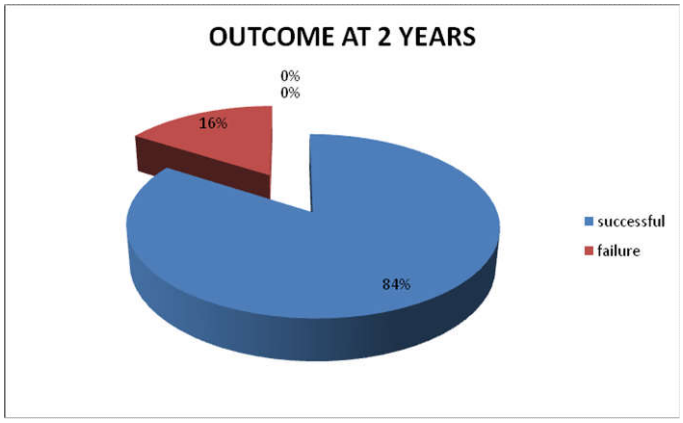
Figure 8. Outcomes of non operative treatment after 1 year

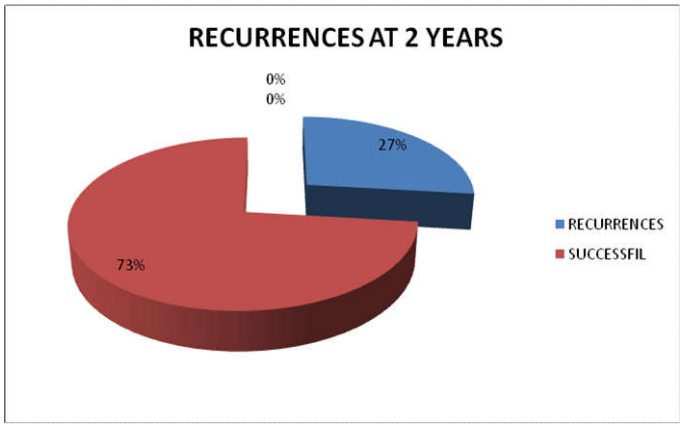


Outcome at 2 years

At the end of 2 years, out of 230 patients entitled in the study, 36 patients didn't respond to the non-operative treatment and were operated. 194 patients responded successfully to non-operative treatment. The percentage of patients responding successfully to the non-operative treatment was 84% while the percentage of patients in whom the non-operative treatment failed was about 16%. Out of 194 patients managed initially by non-operative management, 52 patients later had recurrences with the recurrence rate being 27%.

Outcomes of non-operative treatment	Number of patients	Percentage
Successful	194	84%
Failure	36	16%
Total	230	100%
Recurrences	52/194	27%

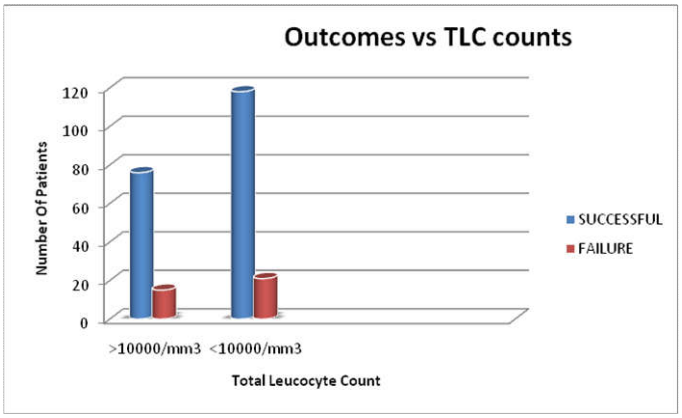




Outcome of non-operative treatment vs TLC counts

Non-operative treatment was successful in 83% of patients with TLC >10000/cm^3 and 85% of patients with TLC count <10000/cm^3.The failure percentages were 17% and 15% respectively. p value 0.7

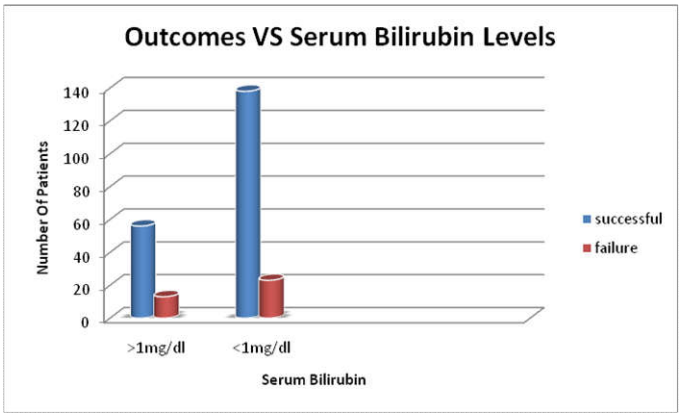
TLC count	successful	failure	total
>10000/cm^3	76(83%)	15(17%)	91
<10000/cm^3	118(85%)	21(15%)	139
Total			230



Outcomes of non-operative treatment vs serum bilirubin levels

Non-operative treatment was successful in 81% of patients with serum bilirubin >1mg/dl and in 86% of patients with serum bilirubin <1mg/dl. The failure percentages were 19% and 14% respectively. p value being 0.3.

Bilirubin levels	Successful	Failure	Total
>1mg/dl	56(81%)	13(19%)	69
<1mg/dl	138(86%)	23(14%)	161
total			230



DISCUSSION

Early appendectomy for long has been gold standard of managing appendicitis, this has been challenged recently by the publication of a series of studies by Pisano, Hansson, Varadhan, Eriksson and others advocating the use of antibiotics as safe and efficient management avoiding unnecessary surgery. There is a growing body of research assessing the potential for non-operative therapy to be extended to uncomplicated appendicitis. Such research promotes the alignment of treatment methods for both complicated and uncomplicated appendicitis. Despite the many substantiated benefits of surgical intervention, non-operative treatment is preferred for uncomplicated acute appendicitis. Non-operative treatment eliminates irreversible loss of organ functionality. In addition, the costs are lower and the risks associated with invasive surgery are excluded (Sakorafas *et al.,* 2012). This approach has many advantages, including high

success and low recurrence rates, reduced morbidity and mortality, less pain, shorter hospitalization and sick leave, and reduced costs. We conducted a study to assess the outcomes of non-operative management of acute uncomplicated appendicitis. A total of 230 patients were entitled in the study. In our study the mean age distribution of patients was 23.3 +- 4yrs. with majority of patients in the 11-20year age group which is comparable to the following study. Anne P Ehlers et al., also conducted a study with the mean age of 26years. In our study the number of females was more than the number of males with a ratio of 117:113. The percentage of females and males was 51% and 49% respectively. Hyong-Chul Park et al., 2014 also conducted a study with the percentage of females and males being 52% and 48% respectively. The hospital stay of patients entitled in our study ranged from 1 to 7 days with the median hospital stay of 3 days. Hansson et al conducted a study with the mean hospital stay of 3 days. Eriksson S et al also had a mean hospital stay of 3 days for the group of patients managed by non-operative method. Salomone Di Saverio et al., 2014 had a mean hospital stay of 4 days for the patients managed non-operatively. In our study the MANTREL score ranged from 3 to 10 with the mantrel score of 7-8 comprising of 49.5% of the total patients comparable to the following study Salomone Di Saverio et alalso conducted a study in which the patients with mantrel score of 7-8 comprised of 51% of the total patients entitled.

In our study Total Leucocyte Count was raised more than 10000/cm^3 in 91 patients out of the total 230 patients comprising 39.5%, while it was less than 10000/cm^3in 139 patients (60.5%). Out of the 230 patients included in our study, Serum Bilirubin was raised more than 1mg/dl in 69 patients (30%) while it was less than 1mg/dl in 161 patients(70%). Ultrasonography was suggestive of acute appendicitis in (45%) 103 patients of the total 230 patients included in the study. USG was suggestive of acute appendicitis in 54%(49/91) patients in whom total leucocyte count was raised more than 10000/cm^3, while it was suggestive of acute appendicitis in 39% (54/139) patients in whom total leucocyte count was not raised more than 10000/cm^3.Hence there was a difference of 15% in the USG findings suggestive of appendicitis between the two group of patients, being 15% higher in patients with Total Leucocyte Count more than 10000/cm^3. Ultrasonography was suggestive of acute appendicitis in 71% (49/69) with serum bilirubin raised more than 1mg/dl, while USG was suggestive of acute appendicitis in only 29% (48/161) of the patients with serum bilirubin less than 1mg/dl. It was noted that there was a difference of 42% in the percentage of the two groups, being 42% higher in the group with serum bilirubin more than 1mg/dl. At the end of one year, 120 subjects were entitled in our study,101 patients responded successfully to the non-operative management comprising 85% of the total patients. 19 patients didn't respond to the non-operative method and required surgical intervention comprising 15%. Out of 101 managed non-operatively initially 25 patients had recurrences later with a percentage of 24% out of which 4 were later operated. Salomone Di Saverio et al also did a study in which the efficacy of non-operative treatment after one year of follow up was 83% which is comparable to our study. Paulino Salminen et al., 2015 conducted a study on 273 patients, the success of non-operative management at the end of 1 year was about 73%. Emad Hokkam, Abdelaziz Gonna, 2016had a success rate of 82% for the non-operative management at a median one year follow up. Gedam et al., 2017 had a success percentage of about 75%. Vons and Barry et al., conducted a study and experienced a recurrence rate of 26% within one year. At the end of 2 years, out of 230 patients entitled in the study, 36 patients didn't respond to the non-operative treatment and were operated. 194 patients responded successfully to non-operative treatment. The percentage of patients responding successfully to the non-operative treatment was 84% while the percentage of patients in whom the non-operative treatment failed was about 16%. Out of 194 patients managed initially by non-operative management, 52 patients later had recurrences with the recurrence rate being 27%. Salomone Di Saverio et al also conducted a study with the efficacy of non-operative treatment being 83% after 2 years of follow up which is comparable to our study. The rate of recurrence was about 14%. Vns, Barry et al also had a recurrence rate of 26% in the group of patients managed by non-operative method.

Conclusion

From this study we conclude that non-operative management of acute uncomplicated appendicitis is a safe, effective and relatively acceptable method, in spite of having higher percentage of recurrence, however each and every patient should be properly assessed clinically before subjecting to non-operative management and further studies are required in this regard in future.

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