

Upfront appendectomy vs interval appendectomy in acute appendicitis with mass formation in pediatric age group: Little difference in major outcome

Abstract

Aim: The aim of this study is to compare Conservative treatment followed by Interval Appendectomy, versus Emergency Appendectomy for the management of appendicular masses in children.

Methods: Retrospective review of all appendectomy performed in Tallaght university hospital, in Paediatric Surgery Department between January 2013 and June 2016. We included 397 procedures of Appendectomy, among those, 16% (n=64) were diagnosed as appendicular masses. Cases were classified into two groups. Group I included those who were managed conservatively and then underwent Interval Appendectomy after 6 to 8 weeks, (n=20) 31.3%. Group II included those who were managed with Emergency Appendectomy, (n=44) 68.8%. The outcomes in the two groups were compared based on three parameters; the duration of hospital stay, the duration of Intravenous Antibiotics and post-operative morbidities.

Results: We found that the median duration of hospitalization in group I was significantly longer than in group II (10 days vs 5 days, $P < 0.0001$). The mean duration of antibiotic therapy in group I was also significantly longer than in group II (10.4 ± 3.17 days) vs (5.19 ± 2.53 days), $P < 0.0001$). Nevertheless, the overall complication rate in Group I was similar to that of group II (38.1% vs 25.6%, $P = 0.304$).

Conclusion: No major difference in outcomes between the conservative and emergency operative approaches in managing appendicular mass in children. However, operative management is more cost-effective with less duration of hospital stay, as compared to the conservative approach.

Keywords: appendicular mass, conservative management, appendectomy, interval appendectomy, emergency appendectomy

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Abbreviations: EA, emergency appendectomy; IA, interval appendectomy; EUA, examination under general anaesthesia; CT, computed tomography; MRI, magnetic resonance imaging; CRP, c-reactive protein; HR, heart rate; TEMP, temperature; US, ultrasound

Introduction

Appendicitis is the most common cause of abdominal pain requiring surgery.¹ Among children presenting with complicated Appendicitis, only 8.8% have an Appendicular mass.² The latter cohort described appendicular mass as a perforated Appendicitis contained by the body defensive mechanisms, to form either a circumscribed abscess or inflammatory phlegmon.²

There are three types of management approaches for the appendicular mass: Emergency surgery, conservative management followed by interval surgery and total conservative management. Conservative management followed by interval Appendectomy remains the mainstay for managing appendicular masses in children. The rationale that conservative treatment is still the gold standard, is that with appendicular mass the tissue anatomy will be distorted and friable which makes emergency appendectomy technically demanding and might finish with Ileo-caeectomy or right hemicolectomy.^{1,3-5}

Nevertheless, no general consensus or agreement on the appropriate line of management of appendicular mass has been embraced.⁶

Moreover, further evidence is needed to support the current approach in managing this condition in the paediatric population.

Our aim from this study is to compare two approaches for the management of appendicular masses in children, which are the Conservative treatment followed by Interval Appendectomy, versus Emergency Appendectomy.

Methodology & materials

In this retrospective analysis study, we aim to compare two different management approaches of appendicular mass, namely Emergency Appendectomy (EA) and Conservative Management followed by Interval Appendectomy (IA). The study was conducted in Tallaght hospital, in Paediatric Surgery Department. We included 397 procedures of Appendectomy, done between January 2013 and June 2016. Among those, 16% (n=64) were diagnosed as appendicular masses.

Cases were classified into two different groups. Group I included those who were managed conservatively and then underwent Interval Appendectomy after 6 to 8 weeks, (n=20) 31.3%. Group II included those who were managed with Emergency Appendectomy, (n=44) 68.8%. The majority of EA were done via open approach, except for 6 cases were done via laparoscopic approach, whereas IA were mainly done laparoscopically, except for 3 cases that were done via open approach. Cases were diagnosed mainly by examination under general anaesthesia (EUA). Some cases were diagnosed intra-

operatively during surgical exploration, and few cases were diagnosed by radiological modalities (Ultrasound/ CT/ MRI).

The outcomes in the two groups were compared based on three parameters; the duration of hospital stay, the duration of intravenous antibiotics and post-operative morbidities. The duration of hospital stay includes the initial hospitalization period, re-hospitalization with any related complications and hospitalization for IA.⁷ The duration of antibiotics is defined as the number of days, that patient had an IV antibiotics therapy as an inpatient.⁸ The post-operative morbidities that were observed included: Ileus, Bowel resection, Faecal fistula, Failure of conservative management, re-hospitalization mainly for recurrence of symptoms (pain, fever etc.), Re-operation, Misdiagnosis & infective complications including wound infection, intra-abdominal collections & drainage of abscess. Post-operative infective complication was defined as any intra-abdominal collection which required drainage either percutaneously or by surgical exploration.⁷ Failure of conservative management was considered as any case that underwent surgical intervention prior to the scheduled interval Appendicectomy.

The demographic data and clinical characteristics of each patient including (duration of symptoms, temperature, heart rate and CRP), upon their presentation to emergency department, were studied to eliminate the bias. Descriptive statistics were calculated for each variable using Microsoft Excel 2013. Continuous data were done using t-Test, while categorical data were compared by the two-tailed Chi-square test. We regarded P value < 0.05 as statistically significant.

Results

Among 397 cases of acute appendicitis, 64 (16%) were diagnosed as Appendicular masses, and 20 (31.2%) were treated conservatively followed by IA, versus 44 (68.8%) treated with EA. The median age was 10 years (range: 2.1 - 15). However, it was noted that 15 (23%) of the study population were <5 years of age. There was no difference in the median age between Group I and Group II (10 years vs 9 years), with P=0.21. Group II contained a significantly higher proportion of males than group I (67.44% vs 38.1% respectively, with P=0.026).

Clinical characteristics

In comparison between the two groups regarding clinical characteristics (Duration of pain, HR, Temp & CRP) as shown in (Table 1), we found no statistically significant differences. The mean duration of pain on average was found to be ≥3 days in both groups.

Table 1 Comparison of clinical characteristics between groups I and group II

	Group I (n=21)	Group II (n=43)	P value
Duration of pain	3.76±2.93	31±1.81	0.2
HR	116.1±18.1	118.2±18.97	0.68
Temp	37.4±0.78	37.4±0.79	0.96
CRP	120.3±76.4	86.6±69.1	0.08

Table 2 Diagnostic modalities

Diagnostic Modality	Group I (n=22)	Group II (n=44)
EUA	13 (65%)	32 (73%)
US	6 (30%)	3 (7%)
MRI	1 (5%)	0
Intra-op	0	9 (20%)

Diagnostic modalities

In group I, 65% of cases were diagnosed by EUA, while in group II, 73% were diagnosed by EUA. Approximately, 70% of the total study group (n=64) were diagnosed by EUA. US modality was used more frequently in group I (30%) as compared to group II (7%), while intra-operative diagnosis was more prevalent in group II (20%). It was noteworthy that only one case was diagnosed by MRI, as demonstrated (Figure 1 & 2).

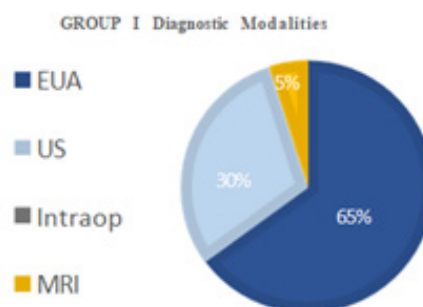


Figure 1 Pie chart illustrating diagnostic modalities of appendicular masses in Conservative management group (I).

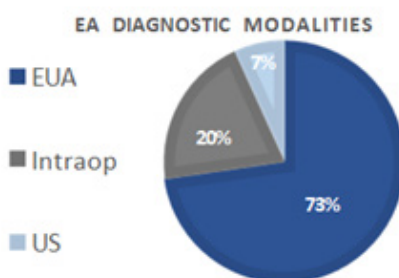


Figure 2 Pie chart illustrating diagnostic modalities of appendicular masses in Emergency Appendectomy group (II).

Duration of hospitalization & IV antibiotics

We found that the median duration of hospitalization in group 1 was significantly longer than in group 2 (10 days vs 5 days, P<0.0001), (Table 3, Figure 3). The mean duration of antibiotic therapy in group I was also significantly longer than in group II (10.4±3.17 days vs (5.19±2.53 days, P<0.0001, Table 3, Figure 4).

Table 3 Duration of hospitalization and Intravenous antibiotics

	Group I	Group II	P value
Duration of hospitalization	11±3.7	5.6±2.6	2.60E-06
Duration of Antibiotics	10.5±3.3	5.3±2.6	5.40E-09

Complications

1) Group I

(As shown in Table 4) There was no mortality, and none of our patients had faecal fistula, bowel resection, or adhesive obstruction and no case was re-operated. In group I (n=20), 85% of cases were treated successfully with conservative measures.

Three cases (15%) failed conservative treatment. One of them was treated conservatively for 7 days, discharged on oral antibiotics, and was re-hospitalized 2 days afterwards with fever and abdominal pain, which mandated laparoscopic appendectomy. The second case was treated conservatively for 5 days, but developed abscess as an inpatient, which mandated laparoscopic appendectomy. The third case was treated conservatively for 6 days, then discharged on oral antibiotics, and was re-hospitalized for persistent abdominal pain one week prior to the scheduled laparoscopic appendectomy and was operated on.

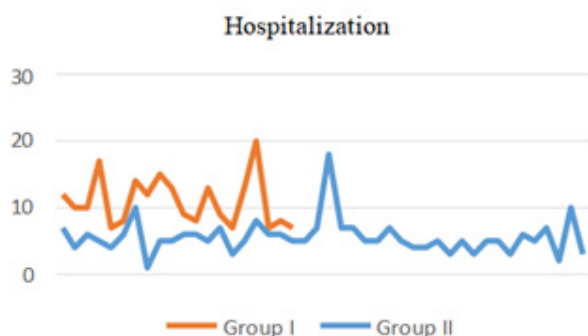


Figure 3 Duration of hospitalization for the two groups.

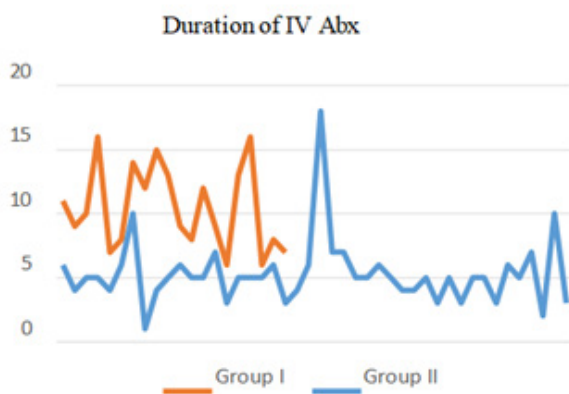


Figure 4 Duration of IV Antibiotics for the two groups (days).

Two cases (10%) of the conservative management (group I), developed infective complications in the form of appendicular abscess. One of them was drained percutaneously under radiological guidance, while the other resolved by Antibiotic treatment. No surgical site infections were observed in (group I).

Recurrence of symptoms was observed in 3 (15%) cases. Two cases required re-hospitalization, while one case was assessed in the emergency department and discharged home.

One case (6-years-old female) was diagnosed by US as an appendicular mass, which was successfully managed conservatively. During interval laparoscopic appendectomy, a twisted paradnexal cyst was identified and removed, while appendix was found to be normal. Post-operative ileus was diagnosed solely in one patient (5%) of the conservative (group I), after undergoing interval Appendectomy.

2) Group II

In emergency appendectomy group, there were overall 5 (11.4%) patients who developed infective complications. Among them, two developed superficial surgical site infections. The remaining three developed intra-abdominal collections, two of which were managed with Antibiotics treatment and one required percutaneous drainage under radiological guidance. Ileus was observed in 6 (13.6%) patients post-operatively.

Overall, only one (2.3%) case could be considered unsuccessful upfront appendectomy. The patient was taken to theatre for appendectomy, intraoperatively found to have retrocaecal appendix mass with pus collection, so decision was taken to postpone appendectomy and abscess drainage performed. The child was treated with intravenous antibiotics post-operatively and was brought back for interval laparoscopic appendectomy.

The overall complication rate in Group I was similar to that of group II (38.1% vs 25.6%, P=0.304), (Table 4 & Figure 5).

Table 4 Comparison of surgical outcomes between conservative measures group (I) and Emergency Appendectomy group (II)

Complications	Group I (n=20)	Group II (n=44)	P value
Failure of management	3 (15%)	1 (2.3%)	0.05
Infective	2 (10%)	5 (11.4%)	0.87
Ileus	1 (5%)	6 (13.6%)	0.3
Recurrence of symptoms	3 (15%)	0	N/A
Re-operation	0	0	N/A
Bowel resection	0	0	N/A
Missed diagnosis	1 (5%)	0	N/A
Overall complications	10 (50%)	12 (27.3%)	0.076

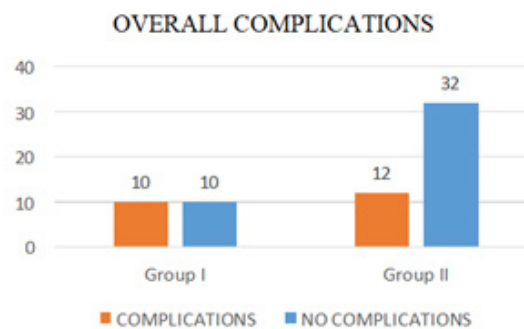


Figure 5 Comparison of outcomes between Conservative & Surgical groups.

Discussion

Conservative management for complicated Appendicitis was introduced by Ochsner (1901).⁹ It remained the gold standard method, which consists of management with intravenous broad-spectrum antibiotics. In case of improvement, the patient undergoes interval surgery.^{2,5,10-13} In case an abscess been diagnosed, a radiologically guided drainage is undertaken.^{3,7,11,14,15} On the other hand, if the patient deteriorates significantly, surgical intervention will be indicated. The justification for conservative treatment is that in case of appendicular mass the anatomy will be distorted, and the tissue is inflamed and friable. This makes Emergency Appendectomy

technically demanding and could end with ileo-caecectomy or right hemicolectomy.^{1,3-5}

However, the advantages of performing emergency appendectomy for appendicular mass include management the condition on a single admission,⁸ avoidance of instituting a second general anaesthesia, preventing significant complications in the case of failure of the conservative measures,⁸ and avoiding a delayed or missed diagnosis of other conditions including neoplasm (0.2% risk in children).⁸

It is reported that emergency appendectomy for appendicular mass is associated with higher morbidity 35.6%,^{2,7} while non-surgical management has 13.5% risk of morbidity with an additional 11% risk following interval appendectomy.⁷ In our study we found that there is no statistically significant difference between the two groups in overall complications rate.

The comparison between the outcomes in the two groups showed no statistically significant difference in overall complications rate. Similar results were reported in other studies as well.³⁻⁵ In this study, the conservative management group needed longer duration of hospitalization and antimicrobial administration than emergency appendectomy group, a finding in line with J. Gillick et al study. These figures could be explained by the group of patients that had recurrence of symptoms, patients who developed appendicular abscess that needed drainage and those who failed to respond to treatment, who obviously had longer duration of hospital stay and intravenous antibiotics. Noteworthy, in our study, appendicular mass was found more common in patients with symptoms lasting ≥ 3 days.⁷ Despite CT scan being superior, ultrasound is deemed diagnostic in 70% of cases.¹⁰ In our study only 30% of cases in the conservative management group were diagnosed using USS while the majorities were diagnosed by EUA.

Conclusions

In this retrospective review, the outcomes among the group who had conservative management followed by IA and those who underwent EA for appendicular mass are similar. The EA is as safe as the IA, particularly if done by a senior surgeon. It was clear that EA is more cost-effective with less duration of hospital stay, as compared to the conservative management and IA approach. Children, who present with pain for 3 or more days, usually will have complicated appendicitis. Ultrasound scan is deemed an essential modality to reach a diagnosis in children with suspected appendicular mass. Further prospective studies are required to compare the current treatment approaches for appendicular mass.

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Data availability

Data available upon request.

Level of evidence

Retrospective review IV.

Ethical approval

This work was approved by the ethical committee in CHI Tallaght.

Code availability

N/A

Consent to participate

N/A

Consent for publication

N/A

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Conflicts of interest

The Authors declare no conflict of interest.

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