We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900
Open access books available

185,000
International authors and editors

200M
Downloads

Our authors are among the

154
Countries delivered to

TOP 1%
most cited scientists

12.2%
Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Chapter

Acute Appendicitis: After Correct Diagnosis Conservative Treatment or Surgery?

Anestis Charalampopoulos, Nikolaos Koliakos, George Bagias, Georgia Bompetsi, Nikolaos Zavras, Dimitrios Davris, Frederich Farrugia and Konstantinos Kopanakis

Abstract

Acute appendicitis is the most common surgical disease presented in ED. Ongoing evidence in the literature, in the last 20 years, shows a lot of benefits in favor of conservative treatment. Despite that conservative treatment does not gain the correct position at the daily practice up to day. A large number of parameters related to acute appendicitis, present diversity in their appearance, so the final estimation of the disease may by unclear and the decision for treatment may be incorrect. We analyze these parameters, aiming to clarify their role in correct diagnosis and decision making on appropriate treatment. In the present study a review of the literature is performed, regarding the etiology, pathology, clinical presentation, laboratory, and imaging data of acute appendicitis. The collection and correct estimation of these parameters, is the key for the correct diagnosis of acute appendicitis. Complicated or uncomplicated cases should be diagnosed preoperatively. The next step is the appropriate treatment, conservative or by surgery. At the present time, excluding generalized peritonitis and sepsis, the majority of patients with uncomplicated acute appendicitis and selected complicated cases can by treated successfully by conservative treatment. The majority of patients do not benefit from appendectomy.

Keywords: acute appendicitis, conservative treatment, decision making, laboratory, radiology, peritonitis, appendectomy, complicated, uncomplicated

1. Introduction

According to the literature of the last 20 yrs., the majority of patients with acute appendicitis should be treated conservatively and not by surgery, as they do not benefit from appendectomy and the operation is considered unnecessary. Unfortunately, worldwide surgical treatment of acute appendicitis remain the gold standard treatment of choice; in a recent multi-centric study in 2018 [1], based in a large number of patients with acute appendicitis, more than 95% of patients were treated by surgery, while conservative treatment underwent less than 5% of the patients. Taking into account the recent literature, the percentages for correct treatment, should be: 80–95% conservative treatment and 5–15% surgical treatment.

At the present study we review and analyze the role of many parameters, influencing the clinical presentation of the patient, the correct diagnosis and decision making for the proper treatment. The role of etiology, pathology and anatomy of acute appendicitis is analyzed. In addition the role of predictive markers/factors, inflammatory markers and radiological data, linked with diagnosis-evolution and severity of acute appendicitis is discussed. Emphasis is given in clinical presentation of the patient and the decision making for conservative or surgical treatment.

2. What's the etiology and pathology of acute appendicitis?

At the moment the appendicular inflammation, is quiet obscure and multifactorial. Carr et al. in a review article [2], describes and analyses several etiologies of acute appendicitis; infection, trauma, ischemia, diet factors, genetic factors, foreign bodies, hygiene and type I hypersensitivity may lead to acute appendicitis. The corresponding pathology reports containing a large spectrum of minor or major changes in mucosa, sub-mucosa, appendicular wall and peri-appendicular area, defining the acute appendicitis as catarrhal, suppurate (phlegmonous), gangrenous (necrotizing) or with signs of peri-appendicitis. Theoretical conceptions about the role of fecolith or lymphoid hyperplasia, creating luminal obstruction, today are under-estimating, as there are severe controversies in medical reports; in pathology reports rarely is found lymphoid hyperplasia with luminal obstruction, on the other hand the percentage of fecoliths in acute appendicitis (7–15%), is lower than in autopsies or in general population, studied with modern imaging studies, performed for other medical reasons (up to 30%). So their implication to inflammatory process is unclear with minor importance. Hence the question: what's the real etiologic factor of acute appendicitis? And what's really happens in appendicular wall? This poses some confusion about the conception of surgeon regarding the treatment of acute appendicitis; conservative or by surgery? In this heading, despite the obscure etiology, there are two key points; a) we must exclude secondary appendicitis, due to tumors of the cecum, appendix or peri-appendicular area. As acute appendicitis is a disease of the middle age (3rd and 4th decade of the life), we must be careful, mostly in aged patients (>50 years, or > 65 yrs. old) with acute appendicitis, although this group of patients represent a small percentage (7–15%) of the patients presented [3]. If conservative treatment is decided, after the acute phase, a colonoscopy and CT scan of the lower abdomen must be performed. b) Inflammatory process of the appendix starts initially at the level of mucosa and sub-mucosa, invaded by neutrophils and sometimes by eosinophils. Later, ulcers may appear [2] and the appendicular wall may be invaded by anaerobes, gram negatives and other microbial agents. This evolution explains the use of antibiotics for the regression of inflammation, if conservative treatment is decided. A multi-centric study (APPAC trial), provide level I evidence data, that antibiotic treatment for uncomplicated acute appendicitis is effective and reduce the rate of appendectomies by 75–85% [4]. Following the natural history of acute appendicitis, a self-regression of the inflammation is feasible at 20% of patients [5]. Having in mind that at the beginning of appendicitis the inflammation involves mucosa and sub-mucosa, one should think the use of anti-inflammatory drugs. At the moment, worldwide, there are not reports for the use of such drugs as a part of conservative treatment. The author, in selected patients with acute uncomplicated appendicitis, used a combination of paracetamol and lornoxicam (an analgesic scheme, often used to treat postoperative pain), as the main treatment in a study with more than 100 patients with uncomplicated acute appendicitis [6], with early onset and duration of symptoms. It seems that this kind of treatment combined with antibiotics, offers

promptly a clinical and laboratory regression of acute appendicitis. Non-steroidal anti-inflammatory drugs may play an important role in conservative treatment, as such effectiveness is observed in other inflammatory intra-abdominal inflammations; e.g. in acute cholechystitis, (chemical inflammation, without microbial involvement at least at the start of inflammatory process). This is a new field of research, although some parameters must be determined: the kind and time (days) of anti-inflammatory therapy, the effectiveness in cases with early onset of symptoms in acute appendicitis, and their use in purulent appendicitis in combination with antibiotics.

3. What's the role of anatomy of appendix in clinical presentation of acute appendicitis?

RLQ pain and rebound tenderness- aka the classic symptoms of acute appendicitis- accounts at about 40% of patients. In a review study [7], a high percentage of variable position and other anatomic characteristics of the appendix, as the length or orientation, may confuse clinicians. Such cases should be studied by modern imaging studies. One should keep in mind that the position of the appendix is extremely variable; De Souza et al., in a retrospective study of 377 cases [8], describes the most common position of appendix during surgery, as follows: retro-cecal location at 43.5%, sub-cecal at 24.5%, post-ileal at 14.3%, pelvic at 9.3%, para-cecal at 5.8%, pre-ileal at 2.4% and other at 0.27%.

4. Is the diagnosis of acute appendicitis easy?

No. Abdominal pain in the right iliac fossa, do not always correspond to acute appendicitis. Negative appendectomies in bibliography vary from 10 to 45% and especially in females. The percentage of misdiagnosed cases is 10%. Using imaging studies; the percentage of negative appendectomies is still at 10–12% [9]. Correct diagnosis is the most difficult step in evaluation of acute appendicitis; what really happens in the intra-abdominal cavity? By meticulous estimation of clinical and laboratory data and necessary imaging data, this parameter may be evaluated quiet good at the present time. Various scoring systems increase the diagnostic accuracy. The older is a clinical one described by Alvarado since 1986. This score may predict acute appendicitis [10], being a useful diagnostic aid, especially for younger colleagues [11]. The AIR score, incorporates CRP as a variable in the score and is more accurate at predicting appendicitis than Alvarado score in those deemed high risk [12]. At the present time, newer scoring systems are used, combining clinical and imaging features, and they also have an important role to distinguish uncomplicated from complicated cases of acute appendicitis [13]. Score systems can aid in selection of patients for surgical or non-surgical management. Various markers are used in scoring systems using parameters from physical, laboratory and imaging studies; age, body temperature, the duration and time of onset of symptoms, white blood cell count (WBC), CRP level, presence of peri-appendicular fluid, extra-luminal free air and the presence or not of a appendicolith in U/S or CT.

The majority of studies reveal a percentage of complicated appendicitis at 5% and uncomplicated cases at 95% [13]. Other reports present a higher percentage of complicated cases up to 20–25%. Trying to select patients for conservative treatment, may be difficult preoperatively. The best categorization may be done after surgery, combining surgical findings during surgery; appendix status, the effect of inflammation in peri-appendicular areas and peritoneum, and the final pathology

report. Even thought, there is heterogeneity in terms used, to describe the type of acute appendicitis. The most often used terms are; simple appendicitis, uncomplicated acute appendicitis, catarrhal appendicitis, purulent appendicitis, complicated acute appendicitis with abscess or phlegmon, dehiscence or rupture of appendicular wall, gangrenous appendicitis, local or diffuse peritonitis, and fecal peritonitis. Laparoscopy offers a correct grading of acute appendicitis [14]. Emphasis is given in complicated cases (grade 3–5) but they represent a small percentage in the total number of patients, with acute appendicitis. Its position for uncomplicated cases (grade 1, 2) is not well determined. Pathology changes and clinical data in ICD-10 system classification, determine 8 types or subtypes of acute appendicitis;

ICD-10: K35 - acute appendicitis.
ICD-10: K35.2 - acute appendicitis with generalized peritonitis.
ICD-10: K35.3 - acute appendicitis with localized peritonitis.
ICD-10: K35.8 - other and unspecified acute appendicitis.
ICD-10: K35.80 - unspecified acute appendicitis.
ICD-10: K35.89 - other acute appendicitis.
ICD-10: K36 Other appendicitis.
ICD-10: K37 Unspecified appendicitis.

5. Are there predictive markers/factors, for the diagnosis, evolution and postoperative complications influencing the course of acute appendicitis?

The history of the disease, clinical examination, WBC, CRP, U/S or CT findings contribute to diagnosis [15] and predict the severity and evolution of acute appendicitis. Postoperative complications are related to the pathology, the contribution of bacteria in inflammation and the type of operation. Early diagnosis in the first 48 h, may be important followed be early management of the disease, and probable for more conservative approach, as antibiotic treatment is a safe and first line therapy for acute appendicitis, with excellent results in uncomplicated cases (patients without diffuse peritonitis), reducing the unnecessary appendectomies [16]. The non-surgical management of uncomplicated appendicitis by the use of antibiotics, predominates as treatment option as it's effective and decreases morbidity [17]. Patient delay for clinical examination and diagnosis is the key factor linked with an increased incidence of complicated acute appendicitis [18]. Today, the use of radiological interventional techniques in combination with antibiotics, extent the spectrum of conservative treatment in many complicated cases of acute appendicitis, as there is possibility for successful treatment-drain of the intra-abdominal abscesses and phlegmon [19], reducing complications compared with surgical treatment [20]. Surgery in such complicated cases is not easy and may lead in right hemi-colectomy due to severe intra-abdominal inflammation during surgery. We consider this effect a catastrophic result of surgery for a benign inflammatory process, in the absence of a local tumor in appendicular and peri-appendicular area.

6. Where should be given attention during clinical examination and estimation of the patient with acute appendicitis?

a. The age and sex of the patient; all reports, mention a disease of the middle age and the majority of patients are between 29 and 40 years old, although the age rage varies from the infantile to older ages. In younger ages exclusion or the presence of septic variables is important, as option treatment must be decided

as soon as possible. In older ages, >50 years or 65 yrs. old, the possibility for complicated cases and the presence of an appendicular or peri-appendicular tumor is higher than in the middle age. Elderly patients present a higher mortality, morbidity, higher perforation rate, higher postoperative complication rate, lower diagnostic accuracy and longer delay from symptoms onset and admission [21], the female sex presents a more difficult diagnosis, mainly in reproductive age. Gynecological conditions and acute appendicitis may be studied in emergency by U/S combined with trans-vaginal ultrasound [22], increasing the diagnostic accuracy for acute appendicitis.

b. The past history (start and duration of symptoms) may be false; the patient many times refers a short period of time with symptoms. Acute appendicitis may have atypical clinical presentation (up 30% of the patients), the existence of atypical location of the appendix, and the presence of the disease in advanced ages creates a vague past history, leading in a wrong option treatment.

c. Analyze the features of the pain; complete clinical examination of the abdomen, with emphasis in palpation of the abdomen. We can diagnose the local signs of inflammation or sings of generalized peritonitis. Deep pain, in deep palpation of the right iliac fossa (visceral pain) reveals the local inflammation. Irritation of the peritoneum is expired by rebound (somatic pain). Colic pain may reveal an appendicular fecolith or intestinal obstruction due to severe inflammation-periappendicular inflammatory mass or tumor. Colic pain coexists more times with a permanent local-visceral pain. Sometimes acute appendicitis is manifested with reflex pain in the right hypochondrium, peri-umbilical, epigastria area or left iliac fossa, with no or attenuated local signs in the right lower quadrat. Reflex pain disappear in a short period of time of some hours and finally appear and predominate local signs of visceral pain in the right lower quadrat. We consider that clinical examination of the abdomen is the optimal method for diagnosis and estimation of severity in patients with acute appendicitis, as it's a fast, easy and may be repeated at times. Surgeon's opinion for acute appendicitis, in combination with laboratory and imaging data yield the best outcomes in patients, for the correct diagnosis in acute appendicitis [23].

7. What's the role of inflammatory markers in diagnosis and grading of acute appendicitis?

There are many inflammatory markers that can be used. Increased levels reflect the severity of acute appendicitis. Very high levels may reveal more complicated cases or sepsis [24]. WBC and neutrophil ratio, CRP, procalcitonine and SER are the most often used markers. We recommend the use of WBC and CRP. They are available in most laboratories and the results are taken in a short time. The use of numerous or novel markers is not recommended as they do not improve the diagnostic ability for acute appendicitis [25].

8. What's the role of imaging data in acute appendicitis?

There are three radiologic examinations available; U/S, CT and MRI [26]. U/S dispose a high diagnostic accuracy for acute appendicitis >90% but a high negative predictive value [27] with limited sensitivity, as the no visualization of appendix during U/S is very often observed. If inconclusive data are reported, and

clinic-laboratory data support the presence of acute appendicitis, further study with CT (when there is no pregnancy) or MRI is recommended [28]. There are five morphological imaging criteria of appendicitis; a. enlargement (diameter) of the appendix>6 mm, b. thickness of the appendicular wall>2 mm, c. Inflammatory compression of the peri-appendicular adipose tissue, d) abscess formation in the right lower abdomen, e) calcified appendicolith. The three first criteria reveal uncomplicated acute appendicitis. A contrast-enhanced CT is an excellent tool for complicated cases and visualization of appendicular wall dehiscence-rupture.

9. Are there special categories of patients with acute appendicitis influencing option treatment?

a. Pregnancy: Acute appendicitis in pregnancy is a complex situation, and collaboration between obstetrics and surgeons offer the best outcomes for mother and fetus [29]. Severe perforated cases of appendicitis and negative appendectomies may lead to premature delivery [30]. There is need for accurate diagnosis and correct option treatment. Most cases are observed in the second trimester of the pregnancy. CT is contraindicated do to pregnancy. Diagnostic imaging data are obtained by U/S and MRI. MRI yields a high diagnostic rate and accuracy in pregnant and guide further option treatment [31].

b. Gangrene of the appendix (or necrotizing appendicitis); it's a special type of appendicitis. There is need for accurate diagnosis and surgery due to generalized peritonitis and sepsis. Recently appear reports for conservative treatment of level evidence II [32]. It's more often observed in pediatric population and represents a percentage of 12–13% in pathology reports. In adults is a rarer phenomenon with lower percentage. The incidence is not well determined as in pathology reports different terms are used; gangrenous appendicitis, complicated appendicitis, perforated appendicitis, or necrotizing appendicitis and the percentage of this group with complicated cases is 10–25% in different reports [33].

c. Immunosuppressed patients; Surgery is the rule to avoid sepsis and deaths.

10. How and when decision making, is taken for patients with acute appendicitis?

After the clinical examination, collection of inflammatory markers and imaging data. This waiting time for few hours, assure a correct diagnosis, the option treatment and do not influence the pathology report if appendectomy will be decided. As more variables are positive for acute appendicitis, the diagnostic accuracy for acute appendicitis is high. Cases should be categorized for the severity. Uncomplicated cases and selected complicated cases of acute appendicitis should be treated conservatively with benefits for patients. Diffuse peritonitis and the evidence of perforated appendix represent surgical cases.

11. What should contain the conservative management of acute appendicitis?

Admission in the hospital, and active observation according to the needs of the patient. Collection and estimation of inflammatory markers and imaging data. Soft

feeding is permitted if there is not nausea, intestinal obstruction or planning for operation. Correction of fluid imbalances due to inflammation. The use of antibiotics is mandatory as is the main therapy in conservative treatment. Antibiotic treatment is performed, according to the instructions for the treatment of intra-abdominal infections [34] and a short scheme of 4 days may be effective, at least in uncomplicated cases. After conservative treatment, an interval time for further intervention tend to be abandoned [35] even more for complicated cases with abscess or phlegmon.

12. Recurrence after conservative treatment

The re-appearance of acute appendicitis after conservative treatment is not easy to be calculated. Most reports mention a percentage of 7–10% with a long period of follow-up [36]. There is a lack of information and heterogeneity about the kind-results of conservative treatment (during the first episode of acute appendicitis). Usually, surgery is followed after a new episode. The pathology report should describe changes of acute appendicitis and not chronic inflammatory changes in mucosa or sub-mucosa, as is the case after appendectomy due to recurrent episodes.

13. Conclusions

Conservative treatment of patients with acute appendicitis is not very popular in surgical community, despite ongoing literature data supporting its role in the majority of patients with uncomplicated and selected cases of complicated acute appendicitis. Uncomplicated cases accounts for the 80–90% of patients with acute appendicitis. At every day's practice, more than 90% of uncomplicated cases undergoing appendectomy and less than 10% are treated conservatively. Conservative treatment should be offered, as an initial approach, to every patient with acute appendicitis. Surgeons should understand that the majority of patients may not need and they do not benefit from appendectomy.

Conflict of interests

The authors declare no conflict of interest.

Abbreviations

RLQ	right lower quadrat
AIR	appendicitis inflammatory response
CRP	C-reactive protein
WBC	white blood cell count
U/S	ultrasounds
CT	computerized tomography
MRI	magnetic resonance imaging
SER	sedimentation erythrocyte rate
ED	emergency department

IntechOpen

Author details

Anestis Charalampopoulos[1*], Nikolaos Koliakos[2], George Bagias[2], Georgia Bompetsi[2], Nikolaos Zavras[1], Dimitrios Davris[3], Frederich Farrugia[4] and Konstantinos Kopanakis[3]

1 National and Kapodistrian University of Athens, Athens Medical School, Attikon University Hospital of Athens, Greece

2 National and Kapodistrian University of Athens, Attikon University Hospital of Athens, Greece

3 National Health System, General Hospital of Halkis, Evia Province, Greece

4 National and Kapodistrian University of Athens, Greece

*Address all correspondence to: achalaral@med.uoa.gr

IntechOpen

© 2021 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/3.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. CC BY

References

[1] Sartelli M, Baiocchi GL, Di Saverio S, Ferrara F, Labricciosa FM. et al Prospective observational study on acute appendicitis worldwide (POSAW) World J Emerg Surg 2018; Apr 16:13-19 doi:10.1186/s13017-018-0179-0

[2] Norman J Carr. The pathology of acute appendicitis. Annals of diagnostic Pathology 2000; 4(1): 46-58.

[3] Emre A, Akbulut S, Bozdag Z, Yilmaz M, Kanlioz M, Emre R, and Sahin N. Routine Histopathologic Examination of Appendectomy Specimens: Retrospective Analysis of 1255 Patients. Int Surg. 2013 Oct-Dec; 98(4): 354-362. doi: 10.9738/intersurg-d-13-00098.1

[4] Paajanen H, Grönroos JM, Rautio T, Nordstrom P, Aarnio M, Rantanen T, Hurmr S, Dean K, Jaetti A, Mecklin JP, Sand J, Salminen P. A prospective randomized controlled multicenter trial comparing antibiotic therapy with appendectomy in the treatment of uncomplicated acute appendicitis (APPAC trial). BMC Surg. 2013 Feb 8;13:3. doi:10.1186/1471-2482-13-3

[5] Anderson RE. The natural history and traditional management of appendicitis revisited: spontaneous resolution and predominance of prehospital perforations imply that a correct diagnosis is more important than an early diagnosis. World J. Surg. 2007; 31:86-92. DOI:10.1007/s00268-006-0056-y

[6] Charalampopoulos A, Dimopoulos I, Koliakos N, Kopanakis K, Liakakos T, Machairas A. Non-complicated acute appendicitis in adults treated successfully by conservative treatment without recurrences. Chirurgia (Bucur) 2017;112:25-32

[7] Barlow A, Muhleman M, Gielecki J, Matusz P, Tubbs S, Loukas M. The Vermiform Appendix. Clinical Anatomy 2013;26:833-842 DOI 10.1002/ca.22269

[8] Sandro Cilindro de Souzaa, Sérgio Ricardo Matos Rodrigues da Costac, Iana Goncalves Silva de Souza. Vermiform appendix: positions and length – a study of 377 cases and literature review. J. Coloproctol (Rio J) 2015;35(4):212-216 Http://dx.doi.org/10.1016/j.col.2015.08.003

[9] Papeš D, Medančić SS, Antabak A, Sjekavica I, Luetić T . What Is the Acceptable Rate of Negative Appendectomy? Comment on Prospective Evaluation of the Added Value of Imaging within the Dutch National Diagnostic Appendicitis Guideline – Do We Forget Our Clinical Eye? Dig Surg 2015; 32:181-182 DOI: 10.1159/000380772

[10] Ohle R, O'Reilly F, O'Brien KK, Fahey T and Dimitrov BD. The Alvarado score for predicting acute appendicitis: a systematic review. BMC Medicine 2011, 9:139 http://www.biomedcentral.com/1741-7015/9/139. doi:10.1186/1741-7015-9-139

[11] Man E, Simonka Z, Varga A, Rarosi F, Lazar G. Impact of the Alvarado score on the diagnosis of acute appendicitis: comparing clinical judgment, Alvarado score, and a new mofified score in suspected apprndicitis: a prospective, randomized clinical trial. Surg Endosc 2014;28(8):2398-2405. Doi: 10.1007/s00464-014-3488-8

[12] D.Kollar, DP McCartan, M Bourke, KS Cross, J.Dowdall.Predicting acute appendicitis? A comparison of the Alvarado score, the appendicitis Inflammatory Response Score and Clinical Assessment. World J Surg 2015;39:104-109 DOI:10.1007/s00268-014-2794-6

[13] Atema JJ, Van Rossem CC, Leeuwenburgh MM.Stoker J,

Boermeester MA.Scoring system to distinguish uncomplicated from complicated acute appendicitis. Br J Surg 2015;102(8):979-990.doi:10.1002/bjs.9835

[14] Mariage M, Sabbagh C, Grelpois G, Prevot F, Darmon I, and Regimbeau J. Surgeon's Definition of Complicated Appendicitis: A Prospective Video Survey Study Euroasian J Hepatogastroenterol. 2019 ; 9(1): 1-4. doi: 10.5005/jp-journals-10018-1286

[15] C Tsioplis 1, C Brockschmidt, S Sander, D Henne-Bruns, M Kornmann . Factors influencing the course of acute appendicitis in adults and children. Langenbecks Arch Surg 2013;398(6)857-867. Doi:10.1007/s00423-013-1096-z

[16] Juha M Grönroos.Clinical suspicion of acute appendicitis - is the time ripe for more conservative treatment.Minim Invasive Ther Allied Technol. 2011 ;20(1):42-5. doi: 10.3109/13645706.2010.496958.

[17] Rodney J Mason. Non-operative management of uncomplicated acute appendicitis: using antibiotics is effective and decreases morbidity Evid Based Med 2013;18(2):67-68 .http://dx.doi.org/10.1136/eb-2012-100819

[18] Hansson LE, Laurell H, Gunnarsson U. Impact of Time in the Development of Acute Appendicitis. Dig Surg 2008; 25:394-399. DOI:10.1159/000180451

[19] Tannoury J and Abboud B. Treatment options of inflammatory appendiceal masses in adults.World J Gastroenterol. 2013 Jul 7; 19(25): 3942-3950. doi: 10.3748/wjg.v19.i25.3942

[20] Simillis C, Symeonides P, Shorthouse AJ, Tekkis PP. A meta-analysis comparing conservative treatment versus acute appendectomy for complicated appendicitis (abscess or phlegmon). Surgery 2010 ;147(6):818-829. doi: 10.1016/j.surg.2009.11.013.

[21] Paola Fugazzola, Marco Ceresoli, Vanni Agnoletti, Ferdinando Agresta, Bruno Amato, Paolo Carcoforo, Fausto Catena, Osvaldo Chiara, Massimo Chiarugi, Lorenzo Cobianchi, Federico Coccolini, Alessandro De Troia, Salomone Di Saverio, Andrea Fabbri, Carlo Feo, Fransesco Gabrielli, Angela Gurrado, Angelo Guttadauro, Leonardo Leone, Daniele Marrelli, Luca Petruzzelli, Nazario Portolani, Francesco Paolo Prete, Alessandro Puzziello, Massimo Sartelli, Giorgio Soliani, Mario Testini, Salvatore Tolone, Matteo Tomasoni, Gregorio Tugnoli, Pierluigi Viale, Monica Zese, Offir Ben Ishay, Yoram Kluger, Andrew Kirkpatrick and Luca Ansaloni. The SIFIPAC/WSES/SICG/SIMEU guidelines for diagnosis and treatment of acute appendicitis in the elderly(2019 edition).World Journal of Emergency Surgery (2020) 15:19 Https://doi.org/10.1186/s13017-020-00298-0

[22] Tabbara M, Evangelopoulos N, Raio L, Banz V, Zimmermann H, Fuchs C, and Exadaktylos A. Transvaginal Ultrasound in Fertile Patients with Suspected Appendicitis: An Experience Report of Current Practice. Emergency Medicine International. Volume 2012, Article ID 481797, doi:10.1155/2012/481797

[23] Hasbahçeci M, Erol C, Törü M, and Şeker M. Effect of surgeon's judgement on the diagnosis of acute appendicitis Ulus Cerrahi Derg. 2014; 30(1): 22-27 doi: 10.5152/UCD.2014.2582

[24] Soylu L, Aydin OU, Yıldız M. Diagnostic value of procalcitonin, C-reactive protein, and erythrocyte sedimentation rate for acute complicated appendicitis. J Clin Anal Med 2018;9(1):47-50. DOI: 10.4328/JCAM.5414

[25] Andersson M, Rubér M, Ekerfelt C, Hallgren HB, Olaison G, Andersson RE. Can new inflammatory markers improve the diagnosis of

acute appendicitis? World J Surg 2014 Nov;38(11):2777-2783. doi: 10.1007/s00268-014-2708-7.

[26] M. Karul1, C. Berliner, S. Keller, T. Y. Tsui, J. Yamamura. Imaging of Appendicitis in Adults. Fortschr Röntgenstr 2014; 186:551-558. DOI http://dx.doi.org/10.1055/s-0034-1366074

[27] Pacharn P, Ying J, Linam L, Brody A, Babcoch D .Sonography in Evaluation of acute appendicitis. Are Negative Sonographic Findings Good Enough? J Ultrasound Med 2019;29:1749-1755

[28] Mostbeck G, Adam J, Nielsen M, Claudon M, Clevert D, Nicolau C, Nyhsen C, Owens C. How to diagnose acute appendicitis: ultrasound first Insights Imaging. 2016 Apr; 7(2): 255-263. doi: 10.1007/s13244-016-0469-6

[29] Flexer SM, Tabib N, Peter MB. Suspected appendicitis in Pregnancy. Surgeon 2014; 12(2):82-86.doi:10.1016/j.surge.2013.11.022

[30] Aggenbach L, Zeeman GG, Cantineau AE, Gordijn SJ, Hofker HS. Impact of appendicitis during pregnancy: no delay in accurate diagnosis and treatment. Int J Surg 2015;15:84-89.doi:10.1016/j.ijsu.2015.01.025

[31] Theilen LH, Mellnic VM, Longman RE, Tuuli MG, Odibo AO, Macones GA, Cahill AG. Utility of magnetic resonance imaging for suspected appendicitis in pregnant women. Am J Obstet Gynecol. 2015;212(3):345 e 1-6:https://doi.org/10.1016/j.ajog.2014.10.002

[32] Nordin AB, Diefenbach K, SalesSP, Christensen J, Besner GE, Kenney BD. Gangrenous appendicitis: No longer complicated J Pediatr Surg 2019 Apr;54(4):718-722. doi: 10.1016/j.jpedsurg.2018.10.064

[33] Monajemzadeh M, Hagghi-Ashtiani MT, Kouhsari LM, Ahmadi H, Zargoosh H, and Kalantari M. Pathologic Evaluation of Appendectomy Specimens in Children: Is Routine Histopatholgic Examination Indicated? Iran J Pediatr. 2011 Dec; 21(4): 485-490.

[34] Sawyer RG, Claridge JA, Nathens AB, Rotstein OD, Duane TM, Evans HL, Cook CH, O'Neil PJ, Mazuski JE, Askari R, Wilson MA, Napolitano LM, Namias N, Miller PR, Dellinger EP, Watson CM, Coimbra R, Dent DL, Lowry SF, Cocanour CS, West MA, Banton KL, Cheadle WG, Lipsett PA, Guidry CA, Popovsky K. Trial of short-course antimicrobial therapy for Intraabdominal infection.N Engl J Med 2015;372:1996-2005.DOI: 10.1056/NEJMoal1411162

[35] Tekin A, Kurtoglu HC, Can I, Oztan S. Routine interval appendectomy is unnecessary after conservative treatment of appendiceal mass. Colorectal diseases 2007;10:465-468 Doi:10.1111/j1463-1318.2007.01377.x

[36] Liang TJ, Liu SI, Tsai TY, Kang CH, Huang WC, Chang HT, Chen IS. Analysis of Recurrence Management in Patients Who Underwent Nonsurgical Treatment for Acute Appendicitis. Medicine (Baltimore) 2016;95(12):e3159. doi: 10.1097/MD.0000000000003159