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Article

Emergent Versus Urgent Uncomplicated Appendicectomy at Al-Diwaniayh Teaching Hospital

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Abstract: Acute appendicitis is the most common cause of acute abdomen in young adults, with surgery as the standard treatment. Recent studies suggest conservative management for uncomplicated cases, though the optimal timing for surgery remains debated. This prospective cohort study at Al-Diwaniayh Teaching Hospital, conducted between November 2021 and December 2022, compared outcomes of patients undergoing surgery within 10 hours (emergent) versus after 10 hours (urgent). Of 839 patients, 725 met the inclusion criteria, with a mean age of 25.48 years. Group 1 (406 patients) and Group 2 (319 patients) showed no significant differences in white blood cell counts, operative times, or post-operative outcomes, including length of hospital stay and complications. These findings suggest that for uncomplicated acute appendicitis, appendectomy can be safely performed within 24 hours, allowing flexibility based on hospital resources without increased risks of complications.

Keywords: Appendicitis, Surgery Timing, Uncomplicated Cases, Operative Outcomes, Hospital Resources

1. Introduction

The most common cause of acute abdominal emergency is acute appendicitis and the best treatment of which is surgical intervention (appendicectomy) [1]. Emergency appendicectomy at the time of diagnosis was the standard of care for treatment of acute appendicitis during last century. Any delay in operation has been believed to increase postoperative morbidity or progress to complicated appendicitis such as perforated appendicitis or periappendiceal abscess [2,3]. However, the concept of emergency appendicectomy has been recently challenged by studies which suggested that acute appendicitis could be treated medically, or delaying surgery did not show any increasing morbidity [4-8].

However, there are other studies showing that appendicitis needed emergency surgical procedure and delay in surgery increased complication and length of hospital stay [9-11]. Previously considered a vestigial organ, the appendix is now linked to the development and preservation of gut-associated lymphoid tissue (GALT) and to the maintenance of intestinal flora. It has been suggested that appendicectomy is associated with increased Clostridium difficile infections and increased subsequent cancer (colon, esophageal) as a result of microbial alteration although this is currently unproven [12].

The theory is that the microbiome of the appendix has a protective function and that the loss of this eliminates an element of beneficial immunologic redundancy [13] The protective effect of an early appendectomy against development of ulcerative colitis has been proposed to be mechanistically linked to the release of dimeric forms of IgA from

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plasma B cells and the Th2 response mediated by IL-13-producing natural killer T cells [14]. The appendix, along with the ileum and the colon, develops from the midgut and first appears at 8 weeks of gestation. As the gut rotates medially, the cecum becomes fixed in the right lower quadrant, thus determining the final position of the appendix. The appendix is a true diverticulum of the cecum as it contains all the histological layers of the colon, although certain differences in the irregularity of crypts remain. As a midgut organ, the blood supply of the appendix is derived from the superior mesenteric artery. The ileocolic artery, one of the major named branches of the superior mesenteric artery, gives rise to the appendiceal artery, which courses through the mesoappendix.

The mesoappendix also contains lymphatics of the appendix, which drain to the ileocecal nodes, along with the blood supply from the superior mesenteric artery. 15,16 Visceral innervation occurs along the superior mesenteric plexus (T10-L1) and the vagus nerves. The appendix is of variable size (5-35 cm in length) but averages 8 to 9 cm in length in adults. Its base can be reliably identified by defining the area of convergence of the taeniae at the tip of the cecum and then elevating the appendiceal base to define the course and position of the tip of the appendix (figure 1), which is variable in location. The appendiceal tip may be found in a variety of locations, with the most common being retrocecal (but intraperitoneal) in approximately 60% of individuals, pelvic in 30%, and retroperitoneal in 7% to 10%.

Agenesis of the appendix has been reported, as has duplication and even 15,16 triplication. Knowledge of these anatomic variations is important to the surgeon because the variable position of the appendiceal tip may account for differences in clinical presentation and in the location of the associated abdominal discomfort. For example, patients with a retroperitoneal appendix may present with back or flank pain, just as patients with the appendiceal tip in the midline pelvis may present with suprapubic pain. Both of these presentations may result in a delayed diagnosis, as the symptoms are distinctly different from the classically described anterior right lower quadrant abdominal pain associated with appendiceal disease.

The tip of the appendix may lay in the left lower quadrant under 2 circumstances. The patient may have a very long appendix that originates in the normal anatomic position in the right lower quadrant, but the tip may extend across the abdominal cavity into the left lower quadrant. Second, the patient may have situs inversus, in which case there is transposition of abdominal viscera. In either case, inflammation of the appendix will manifest as left lower quadrant abdominal pain and tenderness [15].

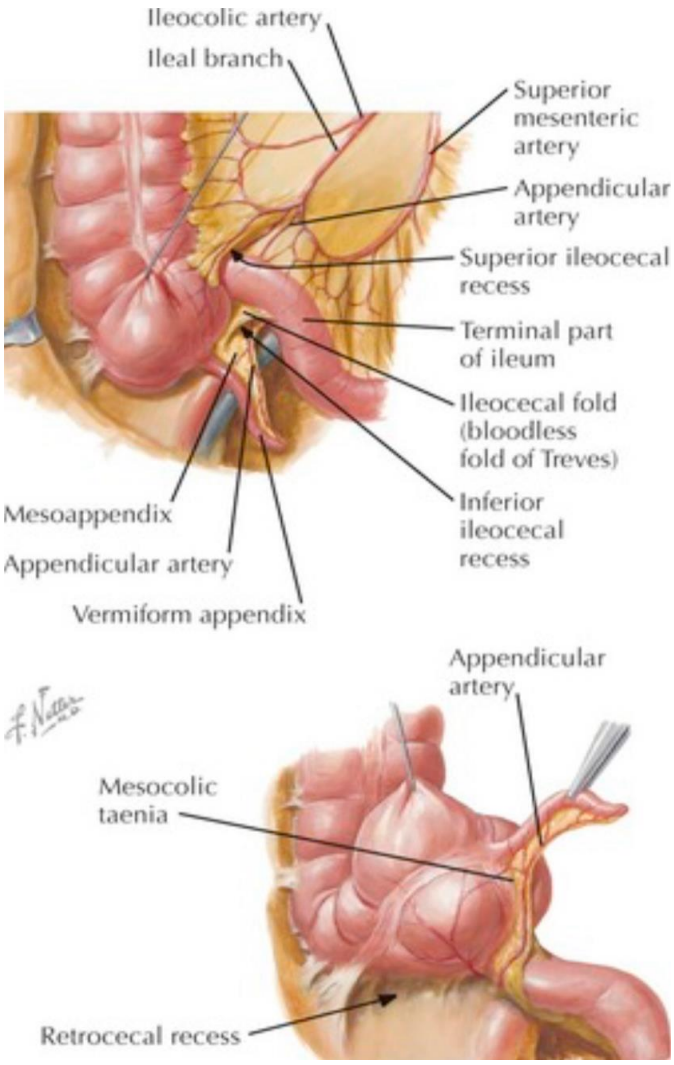

Figure 1. Ileocecal Region and Appendix

ACUTE APPENDICITIS:

Inflammation of the appendix is a significant public health problem [17]. While the rate of appendectomy in developed countries has decreased over the last several decades, it remains one of the most frequent emergent abdominal operations [18]. The etiology of appendicitis is perhaps due to luminal obstruction that occurs as a result of lymphoid hyperplasia in pediatric populations; in adults, it may be due to fecaliths, fibrosis, foreign bodies (food, parasites, calculi), or neoplasia. 15, [19-21] Early obstruction leads to bacterial overgrowth of aerobic organisms in the early period, and subsequently, it leads to mixed flora. Obstruction generally leads to increased intraluminal pressure and referred visceral pain to the periumbilical region.

It is postulated that this leads to impaired venous drainage, mucosal ischemia leading to bacterial translocation, and subsequent gangrene and intra-peritoneal infection. Escherichia coli and Bacteroides fragilis are the most common aerobic and anaerobic bacteria isolated in perforated appendicitis [22,23]. This sequence is not inevitable, however, and some episodes of acute appendicitis may resolve spontaneously. Due to differences in epidemiology, non perforated and perforated appendicitis are considered different diseases [24]. Additionally, since not all non perforated appendicitis progresses to perforations, it is suggested that the pathogenesis of the two conditions may be different.

Pathophysiology and Bacteriology:

Appendicitis is caused by luminal obstruction. 15 The appendix is vulnerable to this phenomenon because of its small luminal diameter in relation to its length. Obstruction of the proximal lumen of the appendix leads to elevated pressure in the distal portion because of ongoing mucus secretion and production of gas by bacteria within the lumen. With progressive distention of the appendix, the venous drainage becomes impaired, resulting in mucosal ischemia. With continued obstruction, full- thickness ischemia ensues, which ultimately leads to perforation. Bacterial overgrowth within the appendix results from bacterial stasis distal to the obstruction. 15 This is significant because this overgrowth results in the release of a larger bacterial inoculum in cases of perforated appendicitis.

The time from onset of obstruction to perforation is variable and may range anywhere from a few hours to a few days. The presentation after perforation is also variable. The most common sequela is the formation of an abscess in the periappendiceal region or pelvis. On occasion, however, free perforation occurs that results in diffuse peritonitis. Because the appendix is an out pouching of the cecum, the flora within the appendix is similar to that found within the colon. Infections associated with appendicitis should be considered polymicrobial, and antibiotic coverage should include agents that address the presence of both gram-negative bacteria and anaerobes.

Common isolates include Escherichia coli, Bacteroides fragilis, enterococci, Pseudomonas aeruginosa, Klebsiella pneumoniae, and others [25]. The causes of the luminal obstruction are many and varied. These most commonly include fecal stasis and fecaliths but may also include lymphoid hyperplasia, neoplasms, fruit and vegetable material, ingested barium, and parasites such as ascaris or pinworm infestation. Pain associated with appendicitis has both visceral and somatic components. Distention of the appendix is responsible for the initial vague abdominal pain (visceral) often experienced by the affected patient. The pain typically does not localize to the right lower quadrant until the tip becomes inflamed and irritates the adjacent parietal peritoneum (somatic) or perforation occurs, resulting in localized peritonitis. 15, [26].

Epidemiology:

The incidence of acute appendicitis ranges from 8.6 to 11 cases per 10,000 person-years. 17, [27]. The disease is slightly more common in males, although perforated cases have no gender predilection. In a lifetime, 8.6% of males and 6.7% of females can be expected to develop acute appendicitis. Young age is a risk factor; nearly 70% of patients are younger than 30 years of age when diagnosed with acute appendicitis. The highest incidence of appendicitis in males is in the 10- to 14-year-old age group (27.6 cases per 10,000 person in a year), while the highest female incidence is in the 15- to 19-year-old age group (20.5 cases per 10,000 person-years). Overall, perforation occurs in 19% of cases of acute appendicitis. Perforated appendicitis has a bimodal distribution, with a predilection for patients at extremes of age. The ratio of perforated to non- perforated appendicitis is significantly higher among patients younger than 5 and older than 65 years, compared to those between 5 and 65 years of age. Although acute appendicitis is relatively uncommon in people older than 65 years, the elderly have perforated disease up to 50% of the time. 17

CLINICAL DIAGNOSIS:

History

It is important to elicit an accurate history from the patient and/or family, in the case of pediatric patients. Inflammation of the visceral peritoneum usually progresses to the parietal peritoneum, presenting with migratory pain, which is a classic sign of appendicitis [28]. Inflammation can often result in anorexia, nausea, vomiting, and fever. Regional inflammation can also present with an ileus, diarrhea, small bowel obstruction, and

hematuria. Pertinent negative history (including menstrual) must be obtained to rule out other etiologies of abdominal pain.

Physical Examination

Most patients lay quite still due to parietal peritonitis. Patients are generally warm to the touch (with a low-grade fever, ~38.0°C [100.4°F]) and demonstrate focal tenderness with guarding. McBurney's point, which is found one-third of the distance between the anterior superior iliac spine and the umbilicus, is often the point of maximal tenderness in a patient with an anatomically normal appendix. Certain physical signs with their respective eponyms can be helpful in discerning the location of the appendix:

A. Rovsing's sign, pain in the right lower quadrant after release of gentle pressure on left lower quadrant (normal position);
B. Dunphy's sign, pain with coughing (retrocaecal appendix);
C. Obturator sign, pain with internal rotation of the hip (pelvic appendix);
D. Psoas sign, pain with hyperextension of the hip joint may induce abdominal pain when the degree of psoas spasm is insufficient to cause flexion of the hip. of the hip (retrocaecal appendix).
E. In addition, pain with rectal or cervical examinations is also suggestive of pelvic appendicitis.

Laboratory Findings

Patients with appendicitis usually have leukocytosis of 10,000 cells/mm3, often with a left shift (a predominance of neutrophils), is present in 90% of cases, with a higher leukocytosis associated with gangrenous and perforated appendicitis (~17,000 cells/mm^3). A normal white blood cell count is found in 10% of cases; however, and it should not be used as an isolated test to exclude the presence of appendicitis. 28,30,31 C-reactive protein, bilirubin, II-6, and procalcitonin have all been suggested to help in the diagnosis of appendicitis, specifically in predicting perforated appendicitis. 28, [29] Pregnancy test is also essential in women of childbearing age. Lastly, a urinalysis can be valuable in ruling out nephrolithiasis or pyelonephritis. If the presentation is strongly suggestive of appendicitis, a positive urinalysis should not be used as an isolated test to refute the diagnosis. Ultimately, no symptom or sign has been demonstrated to be uniquely predictive of appendicitis. 28, [30-32] The same may be said of laboratory tests, which are also weakly predictive when considered in isolation.

Rather, it is the assessment of the collective body of information that allows more precise diagnosis. 28,30-32 For this reason, a number of clinical scoring systems have been developed to serve as predictive models for appendicitis. These have included the Alvarado score (which remains the most well known), [33] the pediatric appendicitisscore, and the appendicitis inflammatory response score, and the adult appendicitis score-to name a few. Of these, the Alvarado score (Table 1), which includes eight clinical and laboratory variables used to assign a numerical score, remains the most widely used and was recently endorsed as the most clinically useful by two independent consensus statements. 31,32 Of note, however, both statements agreed that the sensitivity of an Alvarado score of <4 was most useful in excluding a diagnosis of appendicitis (96% sensitive) but that a higher score lacked specificity in diagnosing appendicitis as the cause of the patient's abdominal pain. 31,32

Table 1. The Alvarado score.

The Alvarado score.		
VALUE		
Symptoms	Migration	1
	Anorexia	1
	Nausea	1
Signs	Tenderness in right lower quadrant	2
	Rebound	1
	Elevation of temperature	1
Laboratory	Leukocytosis	2
	Left shift	1
Total score		10

Adapted from Alvarado A. A practical score for the early diagnosis of acute appendicitis. Ann Emerg Med. 1986;15(5):557-564. Interpretation:

<4 Appendicitis unlikely

5-6 Compatible with appendicitis

7-8 Probable appendicitis

9-10 Very probable appendicitis

Imaging

Imaging is often utilized to confirm a diagnosis of appendicitis because a negative operation rate is acceptable in <10% of male patients and <20% of female patients. Routine use of cross-sectional imaging somewhat reduces the rate of negative laparotomies. Imaging studies are most appropriate for patients in whom a diagnosis of appendicitis is unclear or who are at high risk from operative intervention and general anesthesia, such as pregnant patients or patients with multiple comorbidities [34].

Commonly utilized imaging modalities include:

CT scan:

A contrast-enhanced CT scan has a sensitivity and a specificity of 96% in diagnosing acute appendicitis. 34,35 Features on a CT scan that suggest appendicitis include enlarged lumen and double wall thickness (greater than 6 mm), wall thickening (greater than 2 mm), periappendiceal fat stranding, appendiceal wall thickening, and/or an appendicolith. Periappendiceal fluid or air is also highly suggestive of appendicitis and suggests perforation. CT scan is more sensitive and specific than ultrasound in diagnosing appendicitis.

Ultrasound:

Ultrasonography has a sensitivity of 85% and a specificity of 90%.36 Graded compression ultrasonography is used to identify the anteroposterior diameter of the appendix. An easily compressible appendix <5 mm in diameter generally rules out appendicitis. Features on an ultrasound that suggest appendicitis include a diameter of greater than 6 mm, pain with compression, presence of an appendicolith, increased echogenicity of the fat, and periappendiceal fluid. 37 Ultrasound is cheaper and more readily available than CT scan, and it does not expose patients to ionizing radiation, but it is user- dependent and has limited utility in obese patients.

- **MRI:**

MRI of the abdomen has a sensitivity of 95% and specificity of 92% for identification of acute appendicitis 38 MRI is an expensive test that requires significant expertise to perform and interpret and is usually recommended in patients for whom the risk of ionizing radiation outweighs the relative ease of obtaining a contrast CT scan, i.e., pregnant or pediatric patients. Criteria for MRI diagnosis include appendiceal enlargement (>7mm), thickening (>2 mm), and the presence of inflammation. 39

Differential Diagnosis

Causes of acute abdominal pain that are often confused with acute appendicitis include acute mesenteric adenitis, caecal diverticulitis, Meckel's diverticulitis, acute ileitis, Crohn's disease, acute pelvic inflammatory disease, torsion of ovarian cyst or graafian follicle, and acute gastroenteritis. Frequently, no organic pathology is identified. Obtaining an antecedent history of a viral infection (mesenteric adenitis or gastroenteritis) and a cervical exam in women (exquisite tenderness with motion in pelvic inflammatory disease) are essential before planning any intervention. Detailed menstrual history can distinguish mittelschmerz (no fever or leukocytosis, mid-menstrual cycle pain) and ectopic pregnancies [35].

MANAGEMENT OF ACUTE APPENDICITIS:

The gold standard treatment of acute uncomplicated appendicitis remain prompt appendectomy. The patient should undergo fluid resuscitation as indicated, and the intravenous administration of broad-spectrum antibiotics directed against gram-negative and anaerobic organisms should be initiated immediately. 31,32

For open appendectomy, the patient is placed in the supine position. The Choice of incision according to the patient condition and the surgeon's preference,whether it is an oblique muscle-splitting incision (McArthur-McBurney figure 1) a transverse incision (Rockey-Davis), Lanz incision, right paramedian incision, or a conservative midline incision. The cecum is grasped by the taeniae and delivered into the wound, allowing visualization of the base of the appendix and delivery of the appendiceal tip. The mesoappendix is divided, and the appendix is crushed just above the base, ligated with an absorbable ligature, and divided. The stump is then either cauterized or, if desired, inverted by a purse-string or "Z" suture technique.

In the event of retraction of the appendiceal artery or unexpected bleeding, the incision can be extended medially (Fowler extension). Rutherford Morison's incision is useful if the appendix is para- or retrocaecal and fxed. It is essentially an oblique muscle-cutting incision with its lower end over McBurney's point and extending obliquely upwards and laterally as necessary. All layers are divided in the line of the incision. Skin closure is usually performed in a layered fashion, but in cases with significant abscess or contamination, closure by secondary intention or delayed primary closure has been considered.

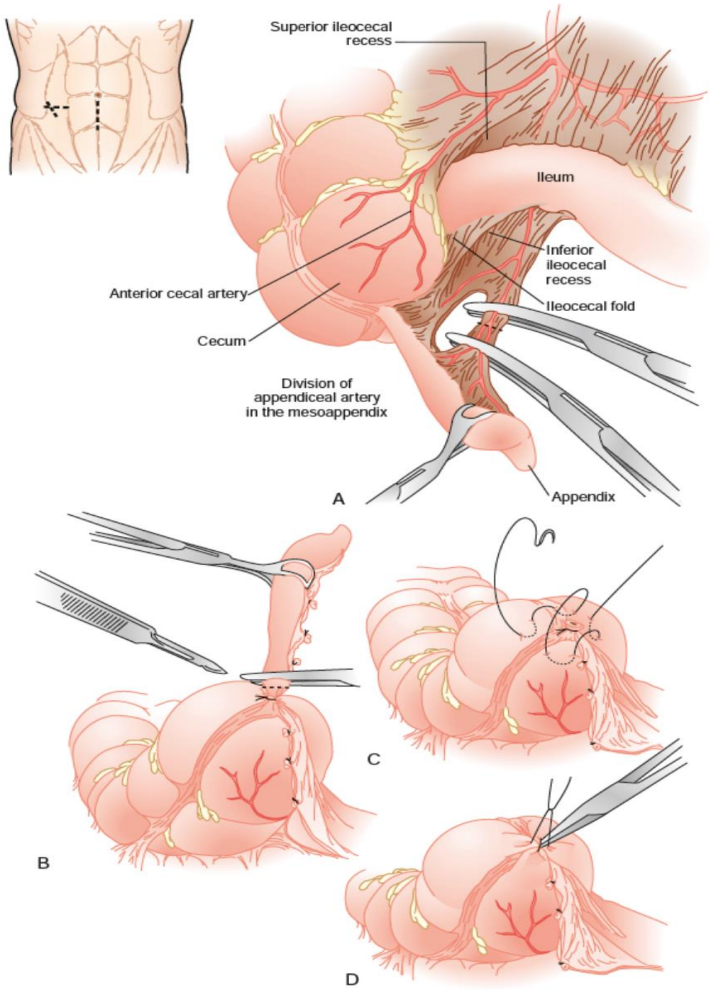

Figure 2. (A) Left, Location of possible incisions for an open appendectomy. Right, Division of the mesoap- pendix. (B) Ligation of the base and division of the appendix. (C) Placement of purse-string suture or Z stitch. (D) Inversion of the appendiceal stump. (From Ortega JM, Ricardo AE. Surgery of the appendix and colon. In: Moody FG, ed. Atlas of Ambulatory Surgery. Philadelphia: WB Saunders: 1999.)

For laparoscopic appendectomy, the patient is placed in the supine position. The bladder is emptied by a straight catheter or by having the patient void immediately before the procedure. The abdomen is entered at the umbilicus, and the diagnosis is confirmed by inserting the laparoscope. Two additional working ports are then placed, typically in the left lower quadrant and in either the suprapubic area or supraumbilical midline, based on the surgeon's preference. Atraumatic graspers are used to elevate the appendix, and the mesoappendix is carefully divided using the harmonic scalpel. The base is then secured with endoloops and the appendix divided

(figure 3). Alternatively, the appendix and mesoappendix may be divided with an endoscopic stapling device. Retrieval of the appendix is accomplished by the use of a plastic retrieval bag. The pelvis is suctioned and irrigated, the trocars are removed, and the wounds are closed. Laparoscopic appendectomy may also be performed with single-site laparoscopic surgical techniques as well based on the experience and preferences of the surgeon.

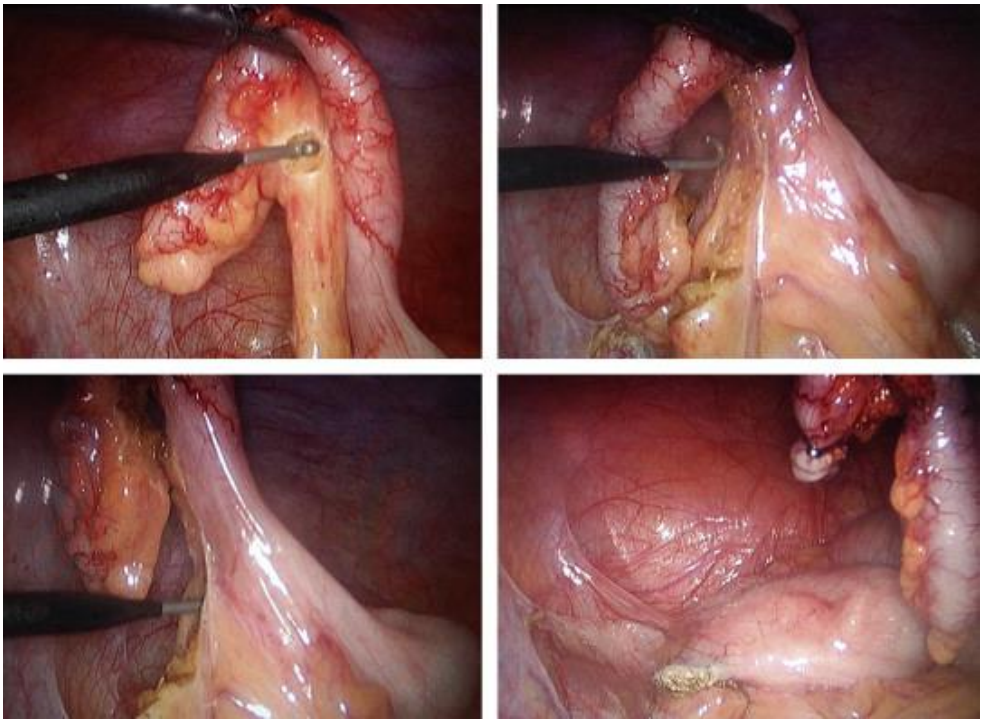

Figure 3. Laparoscopic appendicectomy. (a) Hook diathermy dissection of the mesoappendix. (b) The appendicular artery, ligated with clips, is divided. (c) The appendix base is ligated with absorbable ties. (d) Appendicectomy complete.

Antibiotic administration is not continued beyond a single preoperative dose. 31,32 Oral alimentation is begun immediately and advanced as tolerated. Discharge is usually possible the day after operation.

Postoperative complications:

Postoperative complications following appendicectomy are relatively uncommon and reflect the degree of peritonitis that was present at the time of operation and intercurrent diseases that may predispose to complications.

Checklist for unwell patient following appendicectomy:

1. Examine the wound and abdomen for an abscess.
2. Consider a pelvic abscess and perform a rectal examination.
3. Examine the lungs - pneumonitis or collapse.
4. Examine the legs - consider venous thrombosis.
5. Examine the conjunctivae for an icteric tinge and the liver for enlargement, and enquire whether the patient has had rigors (pylephlebitis).
6. Examine the urine for organisms (pyelonephritis).
7. Suspect subphrenic abscess.

Wound infection:

Wound infection is the most common postoperative complication, occurring in 5-10 per cent of all patients. This usually presents with pain and erythema of the wound on the 4th or 5th postoperative day, often soon after hospital discharge. Treatment is by wound drainage and antibiotics when required. The organisms responsible are usually a mixture of Gram-negative bacilli and anaerobic bacteria, predominantly Bacteroides species and anaerobic streptococci. Common isolates include Escherichia coli, Bacteroides fragilis, enterococci, Pseudomonas aeruginosa, Klebsiella pneumoniae, and others.25

Intra-abdominal abscess:

Approximately 8 per cent of patients following appendectomy will develop a postoperative intra-abdominal abscess. In an era of hospital discharge 24 to 48 hours following appendectomy, patients should be advised prior to discharge that a spiking fever, malaise and anorexia developing 5-7 days after operation is suggestive of an intra-peritoneal collection and that urgent medical advice should be obtained. Interloop, paracolic, pelvic and subphrenic sites should be considered. Abdominal ultrasonography and CT scanning greatly facilitate diagnosis and allow percutaneous drainage. Laparotomy should be considered in patients suspected of having intra- abdominal sepsis, but in whom imaging fails to show a collection, particularly those with continuing ileus [36].

Ileus:

period of adynamic ileus is to be expected after appendicectomy, and this may last a number of days following removal of a gangrenous appendix. Ileus persisting for more than 4 or 5 days, particularly in the presence of a fever, is indicative of continuing intra-abdominal sepsis and should prompt further investigation (see above). Rarely, early during postoperative recovery, a Richter's type of hernia may occur at the site of a laparoscopic port insertion and may be confused with a postoperative ileus. A CT scan is usually definitive [37].

Respiratory:

In the absence of concurrent pulmonary disease, respiratory complications are rare following appendicectomy. Adequate postoperative analgesia and physiotherapy, when appropriate, reduce the incidence.

Venous thrombosis and embolism:

These conditions are rare after appendicectomy, except in the elderly and in women taking the oral contraceptive pill. Appropriate prophylactic measures should be taken in such cases.

Portal pyaemia (pylephlebitis):

This is a rare but very serious complication of gangrenous appendicitis associated with high fever, rigors and jaundice. It is caused by septicaemia in the portal venous system and leads to the development of intrahepatic abscesses (often multiple). Treatment is with systemic antibiotics and percutaneous drainage of hepatic abscesses as appropriate. A screen for underlying thrombophilia should be considered.

Faecal fistula:

Leakage from the appendicular stump occurs rarely, but may follow if the encircling stitch has been put in too deeply or if the caecal wall was involved by oedema or inflammation. Occasionally, a fistula may result following appendicectomy in Crohn's disease. Conservative management with low-residue enteral nutrition will usually result in closure.

Adhesive intestinal obstruction:

This is the most common late complication of appendicectomy. At operation, a single band adhesion is often found to be responsible. Occasionally, chronic pain in the right iliac

fossa is attributed to adhesion formation after appendicectomy. In such cases, laparoscopy is of value in confirming the presence of adhesions and allowing division [38].

2. Materials and Methods

This is a prospective cohort study of the patients who diagnosed with uncomplicated acute appendicitis during the period between November 2021 and December 2022 conducted in the general surgery department in Al-Diwaniyah Teaching hospital where the patients were prepared for surgical operation and divided into 2 group according to the waiting period between diagnosis and the surgery:

Group 1 (emergent): the patients had been waiting for less than 10 hours to the surgical operation.

Group 2 (urgent): the patients had been waiting for more than 10 hours to the surgical operation.

The following exclusion criteria were applied :

1. Age: less than 14 years and more than 65 years
2. Pregnant patients.
3. Immunosuppression or diabetic patients.
4. Patient who had other pathology.
5. Complicated acute appendicitis: perforated, appendicular abscess, gangrenous and appendicular mass.
6. Clinical parameter (pulse rate > 100, spreading tenderness)

After full clinical assessment and complete patient preparation (complete preoperative investigation and prophylactic antibiotic half an hour before surgery with single dose of 3rd generation cephalosporin (ceftriaxone 1g) and metronidazole 500mg according to the guideline protocol), informed consent was obtained from all patients. All patients were operated under general anesthesia, in supine position. After the entire abdomen was prepared with an appropriate antiseptic solution, the abdomen was draped according the planned incision [39].

The gridiron incision at MC Burney point, conventional appendectomy done and wound washed with normal saline and closed primarily. The patients were discharged from hospital after they got improved with mobilization, had normal body temperature, could tolerate oral feeding with normal bowel activity and on oral analgesic medications.

The patients were advised to:

Visit the surgical clinic after 10 days for sutures removal, and to visit the emergency department for any deterioration may occur like fever ,pain or wound discharge. visit the surgical consulting clinic after 30 days of the operation for follow up.

The following parameters were included and compared between two groups:

patient demographical data, comorbidity, waiting time from arrival to the surgery, initial white blood cell (WBC) count at admission, operative time, the post-operative stay in hospital, the post-operative complication, hospital readmissions within 30 days of surgery [40].

Data were collected and managed by the SPSS software 21 version. A P value less than 0.05 was considered to be statistically significant.

3. Results

In our study 725 patients (who meet the inclusion criteria) included between November 2021 and December 2022. The mean age of the patients was 25.48 years. The males count was 363 (50.1%) and the females count was 362 (49.9%). The mean of the waiting time from arrival to the surgery was 10.21 hours. The mean of the operative time was 44.8 minutes. The mean of The post-operative stay in hospital was 30.86 hours. (table 2)

Table 2. The demographics, pre-operative and post-operative characteristics

Total number of cases 725	
Age (years)	25.4 ± 9.2
Comorbidity	41 (5.7%)
Waiting time from arrival to the surgery (hours)	10.2 ± 6.7
White blood cell (WBC) count at admission (x 10^3/mm^3)	11.7 ± 1.4
Operative time (minutes)	44.8 ± 9.3
The postoperative stay in hospital (hours)	30.8 ± 5.2
The postoperative complication	40 (5.5%)
Hospital readmissions within 30 days of surgery	7 (1%)

These patients counts were 406 and 319 included in group 1 and group 2, respectively and Male / Female ratios 205/201 and 158/161, respectively.

Table 3. The frequency distribution of the patients according to gender

		Group 1	Group 2	Total
Male	Count	205	158	363
	% within sex	56.5%	43.5%	100%
Female	Count	201	161	362
	% within sex	55.5%	44.5%	100%
Total	Count	406	319	725
	% within sex	56%	44%	100%

Comparison of demographics and preoperative characteristics between two groups are shown in (Table 4). The age, sex ratio and comorbidities were comparable between the two groups. There were no significant differences in initial white blood cell (WBC) count at admission between two, group1 had mean WBC count of 11.7±1.4 and group2 had mean WBC count of 11.8±1.5 (p value 0.28).

The mean waiting times from arrival to the surgery were 5.05 ± 2.59 (range, 1- 19) for group1 and 16.77 ± 3.28 (range, 3-24) for group 2. The operative times were comparable between two groups, group1 had operative time of 44.3±9.7 and group2 had operative time of 45.3±8.8, (p value 0.17).

Table 4. Comparisons of demographics and pre-operative characteristics between two groups

	Group 1 (406)	Group 2 (319)	P value
Age (years)	25.58 ± 9.3		
Male: Female (n)	205:201		
Comorbidity	22 (3%)		
Initial white blood cell (WBC) count at admission (x $10^3/mm^3$)	11.71 ±1.43		
Operative time (minutes)	44.37 ± 9.71		

The post-operative outcome are shown in (table 5) in which the post-operative stay in hospital, the post-operative complication, hospital readmissions within 30 days of surgery were comparable between two groups [41].

Table 5. Comparisons of post-operative outcomes between two groups

	Group 1 (406)	Group 2 (319)	P value
The post-operative stay in hospital (hours	30.61 ±5.28	31.16 ± 5.14	0.15
Wound infection	16 (2.2%)	13 (1.8%)	0.92
Intra-abdominal infection	1 (0.1%)	1 (0.1%)	0.86
Ileus	5 (0.7%)	4 (0.6%)	0.97
Post-operative complication (total)	22 (3.0%)	18 (2.5%)	0.89
Readmission within 30 days	4 (0.6%)	3 (0.4%)	0.95

4. Discussion

There are controversies regarding the ideal timing of appendicectomy. Some studies have shown that the outcomes of early appendicectomy were better than that of delayed appendicectomy. These support that delayed operation associated with more postoperative complication such as surgical site infection. 9-11,40,41 On the other hand a body of literature have suggested that delaying appendicectomy does not result in increased morbidity, and that appendicitis can be managed as a semi-elective condition. 8, [42-44].

Furthermore, other studies indicated that fatigue and sleep deprivation negatively impact the surgeon cognitive ability and clinical performance which raised the risk of complications. 45,46. We found in our study that postponing surgery after establishing an acute appendicitis diagnosis in the emergency department was not associated with higher complication rates or longer hospital stays (due to a variety of factors, including the patient's fasting state and the order of urgency of the scheduled surgeries) [45].

Initiating treatment with antibiotics and fluids resuscitation in patients after a waiting period for more than 10 hours may be one possible explanation for these findings, and This may enable the control of inflammation. Thus, there were no appreciable differences between the groups of patients who underwent early surgery and those who underwent

delayed surgery in demographics or initial WBC count. Both groups' operative times were comparable. There was no significant difference in post- operative complications rate including intra-abdominal infections, postoperative wound infections or ileus [46].

Nagpal et al. study showed that postponing an appendectomy for up to 24 hours had no negative effects on patient outcomes. The 30-day complications, duration of stay, perforation, and conversion rate did not significantly differ between the early and delayed appendectomy. Yardeni et al.42 found that operating time, perforation rate, or complication rates were not significantly impacted by postponing surgery to the daylight. Stahlfeld et al.43 indicates that it is safe to postpone appendectomy until "normal business hours" and no difference was seen in postoperative and operative morbidity between the early and the delayed groups and that it might even improve the results. According to Ingraham et al.44, postponing an appendectomy for adults with acute appendicitis did not appear to have a negative impact on 30-day outcomes. In a study of 211 patients with appendicitis, Udgiri et al. found that the complication rates, lengths of hospital stays, and readmissions were higher in the delayed appendicectomy group (performed more than 10 hours after admission) than in the immediate appendicectomy group (performed less than 10 hours after admission).

According to Giraudo et al. 10, study of 746 patients who underwent emergency appendicectomy and found that postponing an appendicectomy after 24 hours of symptoms increases the risk of complications. Ditillo et al.[11] study of 1081 adult patients with acute appendicitis, discovered that postponing appendicectomy was risky since there was an increased chance of advanced pathology and complications the longer time that the operation delayed. According to Teixeira et al.4[1] who study of 4529 patients and found that postponing the appendicectomy increased the risk of surgical site infection in individuals with nonperforated appendicitis, but it did not increase the risk of perforation.

5. Conclusion

We maintain the belief that appendicitis is a surgical disease rather than a medical condition. This study found that adult patients with uncomplicated acute appendicitis might safely undergo delayed appendicectomy, and would not worsen the intra-operative or post-operative complications. We conclude that surgeons can decide the proper time for appendicectomy based on the resources that the hospital provide and can perform the procedure in a semi-elective manner for uncomplicated cases. The length of hospital stay or incidence of complications are not significantly increased by performing an appendectomy within 24 hours of presentation. Additionally, this operating pattern lessens the requirement for late-night operations. It can enhance the level of care delivered by surgeons, and provide effective utilization of the operating rooms and the medical resources for life- threatening emergencies.

Recommendations:

1. Larger multicenter study.
2. Provide laparoscopic facility in the emergency department.
3. Estimate the waiting time from the onset of the first symptom until the surgery.

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