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**Surgery
Contents module 1**

ACUTE APPENDICITIS

Guidelines for students and medical interns

**Хірургія
Змістовний модуль 1**

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ACUTE APPENDICITIS

Acute appendicitis is the most common acute surgical disease of the abdomen. The mortality is about 0.2–0.3 % and depend on complications of acute appendicitis. Embryologically, the appendix is a continuation of the caecum from its inferior tip and the appendix is shaped like an inverted pyramid. The caecum is bilaterally sacculated in early childhood with the appendix still at the inferior tip. Further growth of the caecum is unequal. Rapid growth of the right side and anterior aspects of the caecum rotate the appendix to its adult position on the posteromedial aspect below the ileocaecal valve. As the appendix varies considerably in length, the relation of the base of the appendix to the caecum is essentially constant. The base of the appendix can be marked on the surface as the McBurney's point. The vermiform appendix is present only in human beings and certain anthropoid apes. In many herbivorous animals there is a big caecal diverticulum in which bacteriolytic break down of cellulose takes place. Presence of lymphoid tissue in wall of appendix is characteristic of human vermiform appendix.

Appendix varies in length, but the average length is about 10 cm in adult. On longitudinal section the irregular lumen of the appendix is encroached upon by multiple longitudinal fold of mucous membrane.

Structure. – From without inwards the structure of appendix is as follows:

1. A serous coat is composed of peritoneal coat, which covers the whole of the appendix except along the narrow line of attachment of the mesoappendix.

2. Muscle coat – it consists of outer longitudinal muscles and inner circular muscles as seen in case of small intestine. The longitudinal muscle is formed by coalescence of the three taeniae coli at the junction of the caecum and appendix. Thus the taeniae, particularly the anterior taenia may be used as a guide to locate an elusive appendix. The inner circular muscle is continuation of the same muscle in the caecum. The peculiarity of the musculature of the appendix is that there are a few gaps in the muscular layer called "hiatus muscularis". Through this infection from the submucous coat directly comes to peritoneum and regional peritonitis occurs. Through these hiatus muscularis appendix may perforate when there is a rise in tension inside the organ.

3. Submucosa. – The submucous coat of the appendix is very rich in lymphoid tissue. It contains lymphoid follicles which are known as "abdominal tonsil". The number of submucosal lymphoid follicles are few at birth. This number gradually increases to a pick of approximately 200 follicles between the ages of 12 and 20. After that the number is gradually reduced and reaches to about half at the age of 50 years and almost absence of lymphoid tissue at the age of 60 years.

4. The mucous coat resembles that of large intestine.

The appendicular artery is the main arterial supply to the appendix and the appendicular artery is an end artery. It is a branch of the lower division of ileocolic artery and passes behind the terminal ileum to enter the mesoappendix a short distance

from the base of the appendix. The mesoappendix often does not continue up to the tip of the appendix. In (his case the artery lies in direct contact with the tip of the appendix. Inflammation of the appendix will cause thrombosis of the artery. This precipitates gangrene of the tip of the appendix and ultimate perforation.

Accessory appendicular artery supplies the base of the appendix and this artery should be properly ligated otherwise haemorrhage will continue after appendectomy. This is a branch of the posterior caecal artery.

The appendicular vein, which follows the appendicular artery along the free border of the mesoappendix, drains into the ileocolic vein which is a tributary of the inferior mesenteric vein of the portal venous system. Inflammatory thrombus may cause suppurative pylephlebitis in case of a gangrenous appendicitis.

Lymphatic vessels draining the appendix travel along the mesoappendix to drain into the ileocaecal lymph nodes.

If the caecum does not migrate during development to its normal position in the right lower quadrant of the abdomen. Various anatomical positions.

1. Retrocaecal position (commonest irregular position –70 %) – the appendix lies behind the caecum although in majority of cases in an intraperitoneal location. Only in case of long retrocaecal appendix the tip of the appendix remains in the retroperitoneal tissue close to the ureter.

2. Pelvic position (second most common irregular position – 25 %).

3. Subcaecal (2 %).

4. Subhepatic (3 %) – that means the tip of the appendix is towards the liver.

The vermiform appendix play a useful role in the defence mechanism of the body.

1. The lymphoid follicles present in the appendix for maturation of B lymphocytes.

2. The appendix participates in the secretory immune mechanism in the gut. Appendix forms an integral part of the "gut associated lymphoid tissues" (GALT) and forms globulin for immune mechanism. Yet appendix is not indispensable in this regard and removal of the appendix produces no detectable defect in the functioning of the immunoglobulin system.

In 1960s it was shown that carcinoma of colon was found to be higher in incidence following appendectomy than in comparable control groups. But subsequent studies could not prove its soundness.

Aetiology and Pathogenesis.

Obstruction of the lumen of the appendix is the most common cause of the acute appendicitis. When an acutely inflamed appendix has been removed, some form of obstruction to its lumen can be demonstrated in 80 per cent of cases. This may occur due to obstruction of the lumen, obstruction in the wall or obstruction from outside the wall.

In the lumen faecolith and hyperplasia of submucosal lymphoid follicle are the major causes of obstruction. Other causes are intestinal worms e.g.

round worm, thread worm etc., vegetables, fruit seeds, inspissated faeces or barium from previous X-rays.

In the wall, stricture (due to fibrosis from earlier inflammation) or neoplasms of which carcinoid is the commonest are the main causes and outside the wall adhesions and kinks are common in this group.

A closed loop obstruction is produced continuing normal secretion of the appendicular mucosa rapidly produces distension. The luminal capacity of the appendix is very small – 0.1 ml. Secretion of as little as 0.5 ml distal to the block raises the intraluminal pressure to about 50 cm of water. Unfortunately enough, appendicular mucous membrane is capable of secreting at high pressure. Such distension stimulates visceral nerve endings concerned with pain. This produces vague, dull and diffuse pain in the umbilical and lower epigastric region according to nerve supply of the appendix (Referred pain). Peristalsis is also stimulated by such sudden distension, which produces cramping pain superimposed on the dull, visceral pain characteristic in early appendicitis. Such distension of appendix with mucus is known as 'mucocele of appendix'.

Rapid multiplication of the resident bacteria of the appendix also increases distension. Pressure within the organ increases so much that it exceeds venous pressure. Venules and capillaries are occluded, but arteriolar inflow continues resulting in engorgement and vascular congestion of the appendix. At this stage of distension reflex nausea and vomiting start, the visceral pain also becomes severe. Gradually the serosa is involved, more due to presence of hiatus muscularis and local peritonitis ensues. As soon as this develops there is shifting of pain to the right lower quadrant.

When this bacterial invasion occurs to the deeper coats, fever, tachycardia and leucocytosis develop as a consequence of absorption of bacterial toxin and dead tissue products. Distension of appendix with pus is known as 'empyema of the appendix'. Gradually distension increases and arteriolar pressure is exceeded. This occurs in localised areas particularly those areas with poorest blood supply. Ellipsoidal infarcts develop more commonly in the tip, antimesenteric border and at the site of impaction of faecolith. Perforation may occur through such infarcts.

The bacteriology flora, customarily found in acute appendicitis, is a mixed colonic flora with both aerobic and anaerobic organisms. Most frequently seen organisms are *Esch. coli*, enterococci, bacteroides (gram-negative rod), non-haemolytic streptococci, anaerobic streptococci and *Cl. Welchii*.

As a result of inflammation process develop from simple (catarrhal or superficial) appendicitis till destructive appendicitis (phlegmon, gangrene).

Diet plays an important part in producing appendicitis. Rise in incidence of appendicitis amongst the highly civilized society is mostly due to diet which is relatively rich with fish and meat and departure from simple diet rich in cellulose and high residue.

Appendicitis is particularly common in the highly advanced European, American and Australian countries, while it is rare in Asiatics, and Polynesians. Some authors showed, that if individuals from the latter races migrate to countries

where appendicitis is common, they soon acquire the local susceptibility to the disease. Even apes in captivity appear to acquire the human liability to appendicitis. These significant facts satisfy many that the rise of appendicitis among the highly advanced is due to departure from a simple diet rich in cellulose to one relatively rich in meat. But this cannot be the whole explanation, for acute appendicitis occurs in lifelong vegetarians and even in babes at the breast.

Classification

1. Appendicular colic
2. Simple or catharal acute appendicitis
3. Destructive forms: phlegmonous, gangrenous, perforated

Clinical features. Pain is present in all patients with appendicitis. The initial typical pain is diffuse and dull and is situated in the umbilical or lower epigastric region. Sometimes the pain is moderately severe. Intermittent cramping may superimpose on such pain. Gradually the pain is localised in the right lower quadrant. It takes about 1 to 12 hours for such localisation. In some patients the pain of appendicitis begins in the right lower quadrant and remains there. Variation in the anatomical position of the appendix will account for variation of the principal site of the pain. In case of retrocaecal appendix, pain may be complained of more in the flank. In case of pelvic appendicitis, pain may be referred to the suprapubic region. Malrotation of the appendix will lead to more confusion of the site of pain.

Usually anorexia is complained of in cases of appendicitis. This symptom is so constant that the diagnosis should be questioned if the patient is not anorectic.

Nausea, at least of some degree, is present in 9 out of 10 patients with appendicitis. Vomiting is variable – children and teenagers frequently vomit but vomiting may be entirely absent in adult. Most patients vomit only once or twice. Vomiting is usually not persistent. Vomiting appears after the onset of pain. Typically pain, vomiting and temperature constitutes Murphy's triad of this condition. If vomiting precedes pain the diagnosis should be questioned.

The character of bowel function is of little diagnostic value. A few voluntarily submit that defaecation relieves their pain. To the contrary diarrhoea occurs in some patients, particularly in young children.

In over 95 % of patients anorexia is the first symptom, followed by abdominal pain and this is followed by nausea and vomiting.

Temperature. – Appendicitis may cause rise of temperature, but higher temperature is unusual with uncomplicated appendicitis. Temperature elevation is usually restricted to 99° or 100 °F (39 °C). Normal temperature is often present even with advanced appendicitis. In case of generalised peritonitis following rupture of appendicitis temperature may shoot upto 40 °C.

Pulse rate. – The pulse rate is usually normal or slightly elevated. High pulse rate should question the diagnosis. Pulse rate increases in proportion with the temperature of the patient. In case of spreading peritonitis following rupture pulse rate may rise up to 100 per minute.

Investigation – The patient looks anxious in pain and the tongue is dry. On careful inspection, in very acute condition, it may disclose some limitation of the respiratory movement of the lower half of the abdomen.

Palpation. – Presence of peritoneal inflammation can be suspected if cough or percussion on the abdominal wall elicits pain.

Systemic gentle palpation will detect an area of maximum tenderness that corresponds to the position of the appendix and is usually located in the right lower quadrant at or near McBurney's point.

Muscle guarding or resistance to palpation roughly parallel to the severity of the inflammatory process. Early in the disease resistance, if present, consists mainly of voluntary guarding. As peritoneal irritation progresses, voluntary muscle guarding increases and is eventually replaced by reflex involuntary rigidity. One must try to differentiate voluntary guarding as opposed to involuntary rigidity. Involuntary rigidity does not diminish during expiration as is seen in voluntary guarding.

Cutaneous hyperaesthesia can be found out by light stroking of the skin of the right and left side of the abdomen. In acute appendicitis hyperaesthesia is found over Sherren's triangle (formed by the anterior superior iliac spine, the symphysis pubis and the umbilicus).

Rectal examination. – This is important and should be performed in every patient suspected of suffering from appendicitis. Its primary function is to exclude any pelvic lesion particularly in females. Its secondary purpose is to elicit tenderness in cases of pelvic appendicitis. In case of pelvic appendicitis there may not be any tenderness on the anterior abdominal wall, so rectal examination is very essential to exclude such appendicitis. When inflamed appendix lies in the pelvis, presence of a mass or tenderness will be present.

Signs. Rebound tenderness (Blumberg sign). – The classic method of demonstrating peritoneal inflammation is rebound tenderness. In this case gentle pressure is exerted on the inflamed area and sudden release of the hand will cause extreme pain of the patient at the inflamed area. This is called rebound tenderness. The finding of rebound tenderness may be elicited in only half the cases.

Rovsing's sign. – Pain in the right lower quadrant is complained of when palpation pressure is exerted in the left lower quadrant. It is also called 'referred rebound tenderness' and when present is quite helpful in supporting the diagnosis. Retrograde displacement of the colonic gas strikes the base of inflamed appendix or displacement of the ilial loops to the right side of the abdomen to irritate the inflamed appendix is the probable explanation of this sign.

Psoas (Koup's) sign. – This test is performed by having the patient lie on his left side. The examiner then slowly extends the patient's right thigh, thus stretching the iliopsoas muscle. This will produce pain to make the sign positive. This indicates presence of irritative inflamed appendix in close proximity to the psoas muscle. This is possible in retrocaecal appendicitis.

Obturator test. – Passive internal rotation of flexed right thigh with the patient in supine position will elicit pain. This positive obturator sign is diagnostic of pelvic appendicitis.

Razdolskogo sign. – Light percussion on McBurney's point will elicit pain in case of early appendicitis.

Sitkovskogo sign. – Strengthening pain in the right lower square in the position of patient on the left side.

Special Investigations. – 1. Blood examination will reveal moderate leucocytosis ranging from about 10,000 to 18,000 per cubic mm. with polymorphonuclear predominance. It must be remembered that in case of normal total and differential W.B.C. count, the diagnosis of appendicitis should be questioned. In case of perforated appendicitis the total white cell count may rise above 18,000.

2. Urine examination. – Except for high specific gravity due to dehydration, routine urine examination will usually reveal normal result in case of appendicitis. Only when the inflamed appendix lies near the ureter or bladder, white cells and even red cells may be seen in the urine.

3. X-ray examination. – There is no pathognomonic sign of appendicitis in X-ray examination. Plain films may show a faecolith at the appendicular region. A distended loop of small bowel in the right lower quadrant may be seen. Less often a distended caecum or a gas-filled appendix may be detected. In late complicated acute appendicitis straight X-ray may reveal absence of right psoas shadow or absence of small bowel gas in the right lower quadrant.

4. Chest films may be performed to exclude any disease of the base of the right lung as disease in this area may irritate the spinal nerve to simulate the symptoms of appendicitis.

In our clinic we use Kolesov's classification (1972):

– appendicular colic

– destructive appendicitis: a) phlegmonic, b) gangrenous, c) perforated appendicitis.

– complicate: a) appendicular mass, b) appendicular absces, c) peritonitis, d) etc.

Clinical features according to various anatomical positions of the appendix.

Retrocaecal appendicitis. – Rigidity and tenderness may not be so obvious on the anterior abdomen. This is because of the fact that caecum is in front of the inflamed appendix which may be retroperitoneal and is not in contact with the parietal peritoneum of the anterior abdominal wall. Tenderness may be present near the loin. There may be rigidity of the quadratus lumborum. Inflamed appendix may lie in close relation with the ureter and may cause slight pyorrhoea or haematuria.

Pelvic appendicitis. – When the appendix is entirely within the pelvis there may be complete absence of rigidity and tenderness on the right iliac

fossa. Rectal examination is helpful to detect such appendicitis. Tenderness will be present on the right side of the rectovesical pouch or pouch of Douglas. In case of such appendicitis patient may complain of tenesmus and diarrhoea. Cope's obturator test is usually positive in this type of appendicitis. This is due to the fact that inflamed appendix is in contact with the obturator internus muscle. Passive internal rotation of the hip will cause pain in the hypogastric region. Inflamed appendix may lie in contact with the urinary bladder and may cause frequency of micturition and a little bit of pyorrhoea and haematuria.

Preileal and postileal appendicitis. – Continued irritation of the ileum will lead to nausea and vomiting. This symptom becomes very prominent. Tenderness instead of lying on the McBurney's point is elicited more medially near the umbilicus. As inflamed appendix lies near the ileum it may cause slight diarrhoea.

Subhepatic appendicitis. – When the caecum is higher up than its normal position and the appendix is retrocaecal and reaches the subhepatic position, such appendicitis may give rise to difficulty in diagnosis. The case is often diagnosed as acute cholecystitis. In case of such recurrent appendicitis or subacute appendicitis the diagnosis is made of peptic ulcer. So one must be careful and should keep in mind such position of the appendix.

Complications of acute appendicitis.

1. APPENDICULAR MASS. – In majority of cases as soon as the appendix becomes gangrenous, omentum and coils of small intestine cover the inflamed appendix all around. There is no discrete collection of pus inside. This is an attempt of the nature to prevent general peritonitis even if rupture of the appendix occurs. Usually such appendicular mass develops on the 3rd day after the commencement of an attack of acute appendicitis. This is a tender mass on the right iliac fossa. This mass usually resolves by conservative treatment. In untreated cases or when the patient does not react to the conservative treatment such appendicular mass may turn into an appendicular abscess and becomes larger in size.

2. APPENDICULAR ABSCESS. – A progressive suppurative process in an appendicular mass forms an appendicular abscess walled off by the omentum, inflamed caecum and coils of small intestine. Such abscess may follow rupture of the appendix with the expulsion of small content of the appendix distal to the obstruction. The caecal contents cannot come out due to the occluding faecolith. In such appendicular abscess there may be variable pyrexia and slight increase in the pulse rate. There is definite increase of the leucocyte count with relative increase of polymorphonuclear cells. The commonest site of the abscess is in the lateral part of the iliac fossa (from retrocaecal appendicitis). The second common position is in the pelvis. In untreated cases lethal form of peritonitis is produced by secondary rupture of appendicular abscess.

3. SUPPURATIVE PYLEPHLEBITIS. – Ascending septic thrombophlebitis

of the portal venous system (pylethrombophlebitis) is a grave but rare complication of gangrenous appendicitis. Septic clots from involved mesenteric veins produce multiple pyogenic abscess in the liver. It is heralded by chills, spiking fever, right upper quadrant pain and jaundice.

In infants and young children, in young women, during pregnancy and in the elderly appendicitis has got distinctive clinical settings with some peculiarities which will influence management of such cases of appendicitis. So these cases and their peculiarities are mentioned herewith.

4. PERITONITIS

Appendicitis in infants and young children. – Firstly these patients are not capable of giving accurate history and so diagnosis becomes difficult. As the diagnosis is difficult, the treatment is delayed and complications develop. To make the condition even worse in these patients, the disease progresses more rapidly than in adults – gangrene and rupture occur earlier in the course of acute appendicitis. In pre-school children incidence of rupture rate varies from 50 to 80 %. This is because of the fact that the walling-off process is less efficient because of the small and incompletely developed greater omentum. Another problem is diarrhoea, which is not normally seen in adult appendicitis but is quite common in children. Because of diarrhoea, vomiting and vague abdominal pain these patients are often admitted in the medical ward.

Appendicitis in young women. – In women of 20 to 30 years of age misdiagnosis of acute appendicitis is often made. Pain and discomfort associated with ovulation (mittelschmerz), diseases of the ovary, ruptured ectopic gestation, salpingitis, diseases of uterus, infections and other disorders of the urinary system are often misdiagnosed as appendicitis. While taking history and physical examination one must be careful to exclude these possibilities. Even in these cases role of laparoscopy has not been clearly justified. Probably in these cases when symptoms and signs do not progress for several hours, one can exclude the diagnosis of appendicitis by doing barium enema examination. If this visualises the appendix diagnosis of appendicitis may be ruled out. But it must be remembered that negative exploration is to be preferred to miss a diagnosis of acute appendicitis.

Appendicitis during pregnancy. – Appendicitis is the most common extrauterine condition requiring an abdominal operation during pregnancy. Appendicitis occurs more frequently during the first two trimesters. During first 6 months of pregnancy symptoms of appendicitis do not differ much from those in the non-pregnant women. Appendectomy should be performed in these cases as if the pregnancy is not present. Appendectomy at this stage often does not disturb the pregnancy if performed before rupture of appendix, though there is a chance of miscarriage particularly in the first trimester.

During the third trimester, the problem is more, since mortality is about

20 % –10 times greater than that in the first and second trimesters. The clinical picture is also altered because of upward and lateral displacement of the caecum and appendix as a result of enlargement of uterus. Pain becomes higher and more lateral and diagnosis of pyelonephritis must be excluded by urine examination. Microscopical examination of urine will solve the problem. In addition, appendicitis in this last trimester tends to be more serious as delay in the diagnosis leads to increased incidence of perforation. Displaced omentum is unable to wrap up the inflamed appendix. Rupture usually follows generalised peritonitis. Appendicitis in this trimester may lead to premature delivery in 1/4 of the patients.

Moreover acute pyelitis and torsion of the ovarian cyst during pregnancy can be difficult to distinguish from appendicitis. Early appendicectomy is the treatment of choice for appendicitis in all stages of pregnancy.

Appendicitis in the elderly. – Classic symptoms of pain, anorexia and nausea are also present in most old patients but in less pronounced form. Pain in the right lower quadrant is often very mild and causes little initial concern. So diagnosis at early stage becomes a problem. Rigidity of the right lower quadrant is not so pronounced in elderly patients due to lax abdominal wall. Even the case may be wrongly diagnosed as subacute intestinal obstruction. To worsen the condition enemas may be given.

Impaired blood supply and structural weakness of appendix are said to produce early perforation in these patients. But important than this is the delay in diagnosis. In these patients early appendicectomy should be carried out. It must be remembered that elderly patients die because surgeons do not operate in doubtful cases than due to misdiagnoses and removal of normal appendices.

A. Differential diagnosis of acute appendicitis.

1. Acute cholecystitis.
2. Perforated peptic ulcer.
3. Cyclical vomiting – mostly seen in children. Acetone is found in the urine and rigidity is absent.
4. Enterocolitis. – There is intestinal colic with diarrhoea and vomiting. Localised tenderness is absent. Only pre- and post-ileal appendicitis may mimic this condition.
5. Non-specific mesenteric lymphadenitis. – The patient is usually a child below 10 years of age. This is almost invariably associated with upper respiratory tract infection. The pain is usually diffuse less in intensity and tenderness is not sharply localised. True involuntary rigidity is rare. There is shifting tenderness, that means if there is tenderness on the right iliac fossa the patient is turned to left for a few minutes and the tenderness will be noted to be shifted to the midline. Generalised lymphadenopathy including cervical lymph nodes often noticed. Patient is free from pain between attacks. Examination of the blood reveals relative lymphocytosis. If differentiation is difficult, immediate operation is a

safe course, as appendicectomy often helps in resolution of the lymph nodes.

6. Intestinal obstruction.
7. Crohn's disease.
8. Carcinoma of the caecum.
9. Amoebic colitis.
10. Meckel's diverticulitis.
11. Acute pancreatitis.
12. Mesenteric vascular occlusion.

B. Gynaecological disorders. –

1. Salpingitis.
2. Ectopic gestation.
3. Ruptured ovarian follicle (mittelschmerz). – It usually occurs halfway between menstrual periods i.e. about 14th to 16th day of the menstrual period. It occurs in young girls. Ovulation results of spill of sufficient blood and follicular fluid to produce such mild lower abdominal pain. If the right ovary is affected appendicitis may be simulated. Pain and tenderness are rather diffuse. Leucocytosis and fever are absent. There is no history of missed period.

4. Twisted right ovarian cyst.

C. Retroperitoneal causes. –

1. Right ureteric colic.
2. Right sided acute pyelonephritis.
3. Torsion of testis – either descended or undescended testis.
4. Haematoma in the retroperitoneal tissue.

D. Thoracic diseases. –

Basal pneumonia and pleurisy.

E. Other causes. –

1. Henoch-Schoenlein purpura – usually occurs due to bleeding into appendicular and related structures, which can result from blood dyscrasias. Abdominal pain may be prominent, but joint pains, nephritis and purpura are almost always present. Purpuric manifestations should be looked for in these cases.
2. Porphyria;
3. Diabetic abdomen – indicates abdominal pain and vomiting which sometimes may precede coma.

Treatment of acute appendicitis. – Immediate appendicectomy is the treatment of choice in acute appendicitis without rupture. Immediate appendicectomy should be performed to obviate possibility of rupture of appendix and spreading peritonitis.

PREOPERATIVE PREPARATION. – No patient with acute appendicitis should be taken directly to operation theatre on admission. All patients require a preoperative preparation which rarely requires more than 3 or 4 hours or at least

1 hour before the patient is taken to operation theatre. This is more important in case of patients in whom perforation and peritonitis are suspected.

Nasogastric aspiration is helpful in all patients with appendicitis, particularly in those with peritonitis. Intravenous fluid replacement should be started immediately to establish a good urinary output and to replenish the loss through nasogastric aspiration. High temperature is sometime a problem in case of children. Temperature should be brought down and it is better that anaesthesia should not be induced in patients whose temperature is over 39 °C.

Antibiotics are started immediately. Although prophylactic administration of antibiotics is a matter of controversy, the evidence in various reports in the past decade is clearly in favour of antibiotic administration. Antibiotics are of minor benefit unless the appendix is gangrenous or has perforated. But in cases of gangrenous appendix or perforated appendix antibiotics play a major role in reducing the incidence of wound infection if started preoperatively.

Operation. – After the patient is anaesthetised, the abdomen is again thoroughly palpated. This will give a clear idea regarding the size of the mass. Position of the caecum is ascertained to choose the right incision close to the appendix.

INCISION. – When the diagnosis is confirmed McBurney's grid-iron incision is made. When diagnosis is in doubt right lower paramedian incision is preferred. Lanz's transverse incision is very cosmetic and should be applied in cosmetically conscious patients. Rutherford Morison's incision and Battle's incision are hardly used and have fallen into oblivion.

McBurney's gridiron incision. – This is an oblique incision through the McBurney's point perpendicular to the spinoumbilical line at its junction between lateral 1/3 rd and medial 1/3 rd. Though this is the classical McBurney's incision, yet the surgeon should try to feel the caecum and position the incision accordingly, as sometimes caecum may be abnormally placed (even sub-hepatic). The skin, fascia of Camper and fascia of Scarpa are divided along the line of incision. The fibres of the external oblique aponeurosis are split along the line of incision and retracted. The muscle fibres of internal oblique are now seen running perpendicular to the line of incision. These fibres and the fibres of the transversus abdominis are separated by inserting the tip of the artery forceps and opening it. The fingers are now introduced and these muscle fibres are retracted to expose the peritoneum. The peritoneum is picked up by two artery forceps and incised to enter the abdominal cavity.

Luni transverse incision. – This incision is made at a level 2 to 3 cm below the umbilicus and is centred on the midclavicular-midinguinal line. The aponeurosis and the muscles of the abdominal wall are split or incised in the direction of the skin incision. This incision lies in the direction of skin wrinkle lines and is a better cosmetic incision than the McBurney incision. The only

disadvantage of this incision is that the rectal sheath is opened at the medial end of the wound.

Paramedian incision. – A vertical incision is made from 2.5 cm below the umbilicus 1.25 to 2.5 cm to the right of the midline and ends just above the pubis. Skin, superficial fascia and fascia of Scarpa are incised along the line of incision. The anterior rectus sheath is also incised along the line of the incision. The rectus muscle is retracted laterally. The posterior rectus sheath, transversalis fascia and peritoneum are incised in one layer with the help of two pairs of artery forceps and the abdominal cavity is entered. Its advantage is that it can be extended above or below according to necessity. The disadvantage is that (I) the incision is not on appendicular region and lot of retraction is required for appendicectomy. (II) This incision is also more likely to be infected and (III) chance of wound dehiscence is more.

Rutherford Morison 's incision. – It is similar to McBurney's incision but it is muscle-cutting i.e. external aponeurosis, internal oblique and transversus are cut instead of splitting the muscle fibres, thus extending the incision. All the muscles are cut along the line of incision. So there remains chance of wound infection and wound dehiscence and subsequent hernia due to nerve injury.

Battle's pararectal incision. – This incision is hardly used now-a-days. There is chance of damage to the intercostal nerves supplying the rectus muscle over and above wound infection and wound dehiscence. Enthusiastic students are referred to page no. 209 of the Author's 'A Practical Guide To Operative Surgery' for details of this operation.

Technique of operation:

ISOLATION OF THE APPENDIX. – After opening the peritoneal cavity, the two fingers are introduced to get hold of the caecum. Coils of ileum, which has got no taeniae coil, may be taken out. Sometimes sigmoid colon, which has got a mesocolon is taken out. In a viscerotomic cases the transverse colon, which has got omentum attached to it, is withdrawn. Caecum is best withdrawn by following the peritoneum on the lateral side of the abdomen and it reaches the caecum which is relatively fixed because the ascending colon has got no peritoneum in its posterior surface. The caecum, which is relatively whitish, which has got taenia coli and no omentum and mesocolon, is taken out of the abdomen with the aid of a pair of Babcock's tissue forceps. Now the anterior taenia coli is followed downwards to reach the vermiform appendix. Sometimes it is very easy to find out the appendix, when the appendix is more or less exposed as soon as the peritoneum is incised to ask the surgeon 'How do you do', so it is called 'How do you do' appendix. In other cases, it may be very difficult to find the appendix out which may be fixed in the retroperitoneal tissue behind the caecum. In this case the peritoneum on the lateral side of the caecum has to be incised to lift the caecum and appendix with it.

DIVISION OF THE MESOAPPENDIX. – All other portions of bowel are reinserted into the abdominal cavity except the caecum and the appendix which are surrounded by a wet mop to separate them from the abdominal wound. A pair of tissue forceps is applied to the tip of the mesoappendix. The appendix is lifted up with this tissue forceps. The mesoappendix is pierced at its base with a mosquito artery forceps and the appendicular artery is secured with a ligature through this hole. The mesoappendix is now divided close to the appendix till the caecum is reached. One must be careful about the presence of accessory appendicular artery which should be held with ligature. If the appendix is kinked with firm adhesions, this division of the mesoappendix should be done in segments.

REMOVAL OF THE APPENDIX. – The base of the appendix is crushed with a pair of strong artery forceps. By this process only the mucous and the muscular coats are crushed and curled inwards to occlude the lumen but the peritoneal coat remains unaffected. A ligature is tied around the crushed area. A seromuscular purse-string or figure of N-suture is inserted in the caecal wall around the base of the appendix. A pair of artery forceps is applied to the appendix 5 mm distal the ligature. The intervening lumen is emptied beforehand by momentary pressure with an artery forceps. A swab is placed beneath the base of the appendix and the appendix is divided close to the forceps. The stump is cauterised with pure carbolic acid and is invaginated while the purse-string suture is tightened.

The appendix, the knife, the swab and other instruments which have come in contact with the contaminated mucosa of the appendix are placed in a bowl and removed from the field of operation.

The ligature to mesoappendix is re-examined and make sure that it is not oozing. The terminal ileum is drawn out of the wound and inspected for one metre or so to exclude the presence of kinking band of Lane, Crohn's disease, Meckel's diverticulum etc. In female the right uterine tube and right ovary are also palpated. Thus completing the operation, abdominal wound is sutured in layers as usual.

Treatment of appendicular mass. – In these cases conservative treatment (Ochsner-Sherren regimen) should be started immediately. Nature has already localised the lesion and it is better not to disturb such localisation. Surgery at this stage is difficult and dangerous as it is difficult to find appendix due to adhesions and ultimately faecal fistula may form. When 48 hours have passed since commencement of the disease, presence of lump may be felt on careful palpation. With a skin pencil the lump is demarcated.

CONSERVATIVE TREATMENT includes:

(I) Intravenous fluid with dextrose saline and Ringer solution as and when required.

(II) Hourly nasogastric aspiration.

(III) An intake and output chart.

(IV) Diet. – Mouth washes may be given. Otherwise nothing should be given by mouth.

(V) Antibiotic therapy. – A broad spectrum antibiotic should be given intramuscularly. Metronidazole may be **given** intravenously.

A close watch is kept on the patient while he undergoes the conservative treatment. The followings are the **conditions** which should stop the conservative treatment and immediate appendectomy should be carried out. This means, the **nature** is failing to control the disease and there is a chance that the appendix may perforate any moment. The conditions in **favour of** stopping the conservative treatment are: (a) A rising pulse rate; (b) Vomiting or increase in gastric aspiration; (c) Increase in the abdominal pain – suggesting impending spreading peritonitis; (d) Increase in the size of the lump.

Conservative treatment should make the patient better by decreasing the pain, decreasing the amount of gastric aspiration (which indicates the return of peristalsis), temperature is lowering down and pulse rate is becoming normal and the **size of** the lump is reducing considerably and ultimately disappears. About 90 % of cases resolve without any problem. The **patient** is kept under observation for further 4 to 5 days after resolution of the lump. Before the patient is discharged he should **take** normal diet. He is instructed to have appendectomy done (interval appendectomy) 6 to 8 weeks after his discharge.

Treatment of appendicular abscess. – Immediate drainage under antibiotic cover is the treatment of choice. The incision for drainage is made just medial to the anterior superior iliac spine at the level of the most prominent portion of the appendicular abscess. The muscles are split and the lateral edge of the peritoneum is exposed. The peritoneum is pushed medially so that the mass surrounding the appendix is approached from its lateral peritoneal aspect. If the pus is under pressure, the abscess will rupture automatically. Otherwise a finger should be slowly introduced into the abscess and its adhesions are broken down by blunt dissection. Care is taken not to breakdown adhesions walling-off the medial aspect of the abscess mass. This technique is mainly adopted for the commonest retrocaecal appendix.

If the appendicular abscess is situated more medially the same incision for appendectomy is made. When after opening the peritoneum one sees appendicular abscess, it is better to drain the abscess and come out.

A pelvic abscess may be drained in the female into the vagina and in the male into the rectum.

If the appendix is not removed when the abscess is drained, interval appendectomy should be done 6 to 8 weeks after the wound has healed.

Навчальне видання

Хірургія
Змістовний модуль 1

ГОСТРИЙ АПЕНДИЦИТ

Методичні вказівки
для студентів та лікарів-інтернів

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Surgery
Contents module 1

ACUTE APPENDICITIS

Guidelines for students and medical interns