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IP Journal of Surgery and Allied Sciences

Journal homepage: https://www.jsas.co.in/

Review Article

Abdominal examination: Invaluable clinical findings and their interpretations

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ARTICLE INFO

Article history:
Received 11-10-222
Accepted 02-11-2022
Available online 23-01-2023

Keywords:
Abdomen
Physical examination
Inspection
Palpation
Percussion
Auscultation
Physical signs

ABSTRACT

A thorough history, which may continue till the end of the consultation, helps the clinician understand the possible disease condition, its severity, and the overall physical & mental status of the patient. Physical examination, which practically starts as soon as the doctor meets the patient, builds upon these observations. After completing the general examinations attention should be directed to the examination of all the systems with special emphasis on the system related to his complaints i.e., an abdominal examination in case the patient has abdominal complaints. Assimilation of the clinical observations will enable one to arrive at a probable diagnosis.

1. Introduction

Nowadays widespread availability of various imaging modalities like ultrasonography (USG), computerized tomography (CT) scan, magnetic resonance (MR) scan, and various endoscopic means make clinical diagnosis relatively easy and there is a natural tendency to neglect clinical examinations. However, with 10% of the Indian population still living below the poverty line access to basic health care is still a big challenge in rural India, too much dependency on technology for those practicing in remote areas is impractical.[1,2] Many imaging studies are operator-dependent and surgeons are well-advised to hone their clinical skills rather than depend on investigative reports.

The performance of a good and appropriate abdominal examination is the key to arriving at a management plan for a patient with abdominal complaints. History taking and physical examination are imperative in the day-to-day practice as only those with sound clinical judgments can judicially utilize the investigative tools. This article is based on an extensive review of literature on clinical examination of the abdomen both acute and chronic.

2. Review

The term "abdomen" is derived from the Latin "abdere" meaning "to hide".[3] The superior extent of the abdomen extending beneath the rib cage and the inferior extents within the pelvis are hidden from the palpating fingers of the clinician.

Most of the abdominal examination is performed with the patient lying supine, arms by the side, and head resting on a pillow. Examination of the abdomen includes the examination of the skin, abdominal wall, and its contents.

Before starting the examination, the surgeon should ensure that his hands are warm, dry, and sanitized. It is prudent to introduce oneself at first, identify the patient, explain the examination procedure and obtain consent. Privacy must be ensured. A relaxed, cooperative, and quiet patient in the presence of a chaperone will go a long way in proper elicitation of signs and most importantly avoiding allegations of improper conduct.[4]

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https://doi.org/10.18231/j.jsas.2022.024

The patient should be asked to empty the bladder. Examiner should stand on the right side of the patient. Ideally, the patient should be exposed from nipples to the knees but practically a sheet is placed at the level of the pubis to keep the groins exposed but the genitalia covered, so that the latter area may be examined easily when the time comes without asking the patient to disrobe. Findings are noted under the following headings:

3. Inspection

The patient should lie quietly in a supine position with hands by the side. It should be performed very keenly in a well-lit room. Daylight projected tangentially on the patient is preferable (mild jaundice may be missed in artificial light).[5] The patient is inspected from the foot end as well as the right side (from above and tangentially).[6]

3.1. Attitude

Patients with peritonitis will lie still as movement will exacerbate pain, while those with colicky pain will be tossing on the examination couch.[6]

3.2. Shape/contour

1. *Scaphoid:* poor nutrition.
2. *Distended:* obesity (Fat), ascites (Fluid), intestinal obstruction (Flatus), constipation (Feces), gravid uterus (Fetus), tumors (Fatal growth) - 6 F's.
3. Flat: Normal.

3.3. Symmetry

A localized bulge (with an expansile impulse on cough) is a feature of an abdominal wall hernia. Organomegaly and masses are other causes of the asymmetric abdomen.

3.4. Flanks

Fullness in ascites (shifts with the change of posture).

3.5. Movement of the abdominal wall with respiration

Restriction of movement either localized (right iliac fossa in acute appendicitis) or generalized (peptic perforation) is an indication of underlying inflammation (peritonitis). Localized pain on asking the patient to cough is a sign of peritonitis (Dunphy's sign).[7]

3.6. Umbilicus

Everted umbilicus points towards tense ascites / raised intra-abdominal pressure. A symmetrically distended abdomen with bulging flanks and everted umbilicus suggests the presence of ascites (gaseous distension makes the abdomen protuberant). Sister Mary Joseph's nodules are seen in disseminated intra-abdominal malignancy.[8] Other changes worth noting are inflammation, concretions, granuloma, and discharge from umbilical fistulae. The umbilicus is normally central in position; it is pushed down in ascites or upper abdominal swellings and pushed up in lower abdominal swellings (Tanyol's sign).[9]

3.7. Skin Changes

Color, sinus/fistula, stomas, striae, spider angiomas (more than 5 in the distribution of superior vena cave is pathological), surgical scar (wounds that heal cleanly by primary intention produce thin and regular scars, while infected wounds heal by secondary intention and produce wider and irregular scars).

3.8. Peristalsis

It is normally visible in thin individuals. In the upper abdomen propagation from left to right occurs in gastric outlet obstruction and from right to left in transverse colon obstruction. Peristalsis progressively moves downwards in a step ladder pattern in case of small bowel obstruction.

3.9. Pulsation

Normally seen in epigastrium; prominent in the abdominal aortic aneurysm (AAA).

3.10. Discoloration/bruise

Perumbilical (Cullen's sign) or flanks (Grey Turner's sign) are seen in intra-abdominal and retroperitoneal bleed (ruptured AAA/pancreatitis) respectively.[8] Yellow pigmentation in the umbilical region is seen in biliary ascites (Ransohoff sign).[10]

3.11. Dilated veins

Dilated paraumbilical veins with cephalad blood flow is typically seen in cirrhosis of the liver with portal hypertension. Similar flow in dilated paraumbilical veins in the lower abdomen is a feature of obstruction in IVC. Tortuous veins radiating from the umbilicus or Caput Medusae (Cruveilhier sign) due to hepatofugal blood flow through veins in the falciform ligament is a rare finding of portal vein thrombosis / portal hypertension.[3]

3.12. Masses

It is important to differentiate between intra-abdominal and parietal masses by doing the head/leg raising (Carnett's) test.[11] A parietal mass will remain the same size or become more prominent, while an intra-abdominal mass will become less prominent or disappear on performing the test. The clinician should note the number, site, size, shape, surface, margin, movement with respiration, pulsatility, and

any peristaltic movements associated with an abdominal lump. Parietal swellings must be examined for visible expansile impulse on coughing, a feature of uncomplicated ventral hernia.

3.13. Other examinations as part of abdominal examination

As part of the abdominal examination the back, renal angles, hernia orifices, genitalia (not to forget the posterior surface of the scrotum for discharging sinuses), perineum should also be thoroughly inspected for any bulging/swelling, inflammation, edema, and ulceration. Any deformity of the spine or paravertebral swelling should be noted (spinal diseases may present with radiating pain to the contiguous abdominal segment which gets aggravated by cough or change of posture).

4. Palpation

The patient should lie in 45^0 semi-recumbent positions, with the knees slightly flexed. For patients presenting with abdominal pain, one should note the site of maximum pain so that at the time of the palpation the examiner starts palpating gently at an area furthest away from the area of maximum tenderness. This ensures that the patient is not made unduly apprehensive by pain which may make elicitation of subtle signs difficult.

It is worth remembering the differences between *radiation of pain* (sharp/ radicular pain which follows specific nerves from the point of its origin in a band like fashion e.g. in herniated disc pressing on the nerve root pain follows the sciatic nerve, loin to groin radiation in ureteric colic), *referred pain* (where the source is at one point and goes to be felt at another place having the same segmental innervation as the site of the lesion e.g. in inflammation of gallbladder and adjoining diaphragm supplied by C 3,4,5 pain is referred to right shoulder tip which has cutaneous supply from supraclavicular nerve C3,4 which originates from same spinal segment i.e. the nerve fibres converge at the same spinal segment; left shoulder tip pain when patient is supine or in the Trendelenburg position in splenic rupture- Kehr's sign) and *shifting of pain* (in acute appendicitis pain is initially felt at periumbilical area- referred through T10 spinal segment- shifts to right iliac fossa with the onset of parietal peritonitis).[12,13]

In chronic abdominal pain, on asking the patient to raise the head or legs in a supine position an increase or no change of pain on palpation suggests that the abdominal wall is the origin of the pain while a decrease or disappearance of pain suggests an intra-abdominal pathology (Carnett's sign).[14]

The clinician should either sit or kneel by the side of the patient so that the wrist and the forearm are aligned horizontally to the patient's abdomen. This will make the palpation gentle by minimizing pressure during palpation. The pulp and edges of the middle three fingers are used to elicit the signs as the patient breathes in and out. The palpation should be done sequentially, initially superficial, then deep and finally palpation to detect organomegaly and some specific maneuvers.

4.1. Superficial palpation

The different quadrants are first examined for the localized rise of temperature, the feel of the abdomen (normally soft and elastic), tenderness, guarding (voluntary contraction to avoid pain), or rigidity (involuntary contraction of the abdominal musculature in patients with underlying inflammation) either localized or generalized- board like. On diverting the patient's attention guarding may disappear (thereby differentiating it from involuntary rigidity). Cutaneous hyperesthesia to light touch occurs in inflammatory intra-abdominal pathology causing parietal peritoneal inflammation. Hyperesthesia at the Sherren's triangle (triangle formed by antero-superior iliac spine, umbilicus, and symphysis pubis) is a helpful sign in acute appendicitis, hyperaesthesia inferior to the tip of the right scapula (Boas' sign) in acute cholecystitis.[15,16]

4.2. Deep palpation

Deep tenderness: Deep palpation of all nine regions is next performed similarly with gentle, steady but firmer pressure. Tenderness in any of the nine regions indicates a subjacent inflamed organ- acute cholecystitis (Murphy's sign- tenderness right upper abdominal quadrant with catch of breath at the height of inspiration), Mcburney's point tenderness in acute appendicitis, and tenderness in the left iliac fossa in amoebic typhlitis/diverticulitis in elderly.[16] Tenderness along with rigidity and rebound tenderness (Blumberg's sign) — severe pain on the release of pressure of palpating hand- occurs when the inflammation spreads to the overlying parietal peritoneum irritating the somatic nerves.[17]

1. Mass: While palpating an abdominal mass any local rise of temperature or tenderness is first noted, followed by the corroboration of the inspectorial findings of the number, location, size, shape, surface, margin, mobility, etc. The aim is to decide whether it is parietal or intra-abdominal, and in case it is later the likely organ of origin and its nature. Retro-peritoneal lumps become less prominent in the knee-elbow position. If it is not possible to "get above" an upper abdominal swelling i.e., the upper margin is not palpable, it may be arising from the liver, gallbladder, spleen, stomach, or kidney. For a lower abdominal mass if it is not possible to "get below" i.e., the lower margin is not palpable, then it is likely to be originating from the pelvic organs (uterus, ovary, bladder, rectum). Upper abdominal swellings

arising from the liver, gallbladder, spleen, and stomach move downwards during inspiration because of their proximity to the diaphragm, while those arising from structures with a mesentery or pedicle (mesentery, small bowel, transverse colon, omentum, uterus) can be moved freely by the palpating hand.[18]

2. Other information which needs to be documented are fixity, consistency, impulse on cough, reducibility, compressibility, pulsatility (expansile or transmitted), and the percussion note of the swelling (mass arising from gas-filled viscus is tympanitic).
3. *Fluid thrill:* Flicking movements with the fingers of the right hand on the right flank elicits a thrill palpable by the left hand placed on the left flank. A third hand is placed on the midline to dampen any wave transmitted through the subcutaneous fat. In general, the fluid thrill will be positive in the presence of tense, huge ascites.[18]

4.3. Palpation for organomegaly

1. *Liver:* Palpation is started from the right lower quadrant (RLQ) and progressively moved a few cm up while the patient breathes in and out till the inferior margin of the enlarged liver touch the radial border of the palpating hand as the patient breathes in. The degree of extension below the costal margin along the right mid-clavicular line (MCL), the surface (smooth/irregular), margin (blunt/sharp/irregular), and consistency need to be noted.[18] Hard, nodular hepatomegaly suggests liver secondaries. Tender hepatomegaly is suggestive of hepatitis.
2. *Gallbladder:* A tense, tender, pyriform-shaped structure in the right upper quadrant (RUQ), which moves with respiration and merges with the inferior margin of the liver is likely to be a distended gallbladder in acute cholecystitis (Zackary Cope's sign).[19] In presence of clinical jaundice a palpable, non-tender gallbladder is found in the carcinoma head of the pancreas (Courvoisier sign).[16]
3. *Spleen:* The patient is slightly rolled towards the examiner with the left hand pushing forward on the patient's left loin. Starting from RLQ the palpating right hand is moved towards the left upper quadrant (LUQ) during expiration. The edge of the enlarged spleen touches the palpating hand at inspiration. It has a notch on its anterior border and it is not possible to get above it. It is non-ballotable and the hand cannot be insinuated between it and the costal margin. It is dull on percussion.[18]
4. *Kidney:* It is palpated bimanually with the left hand placed below the lower ribs on the loin pushing the retroperitoneal contents up to the examining right hand. It may be possible to feel both the poles of the kidney. It has a smooth surface, enlarges inferiorly, and is ballotable. There is a band of colonic resonance on percussion.[18]

4.4. Some maneuvers at the end of palpation

1. *Cope's Psoas test:* In acute appendicitis hyperextension of the right hip while lying on the left lateral position, causes pain as it stretches the psoas muscle on which lies the inflamed retrocaecal appendix. This test is also positive in psoas abscess.[19]
2. *Rovsing's sign:* Referred tenderness or referred rebound observed in acute appendicitis is pain felt in right lower quadrant when the left lower quadrant is pressed is observed in acute appendicitis (due to shift of colonic gas).[13]
3. *Cope's Obturator test:* Flexion and internal rotation of the right hip cause pain in patients with a pelvic type of inflamed appendix lying on the obturator internus muscle. It is also evident in a pelvic abscess or inflammatory mass in contact with the obturator.[19]

5. Percussion

Percussion is performed by a smooth, floppy movement of the wrist. The middle finger of the right hand (plexor) hammers onto the middle finger of the left hand (pleximeter). Solid and fluid-filled structures elicit dull and stony dull notes respectively, and gas and air-filled structures are tympanitic.

Shifting dullness: Percussion is done along the resonant midline up to the suprapubic region and thereafter from the center of the abdomen to the flank until the zone of dullness is noted. The finger is kept on the spot of dullness and the patient is turned to the opposite side (for 30 seconds) In ascites repeat percussion in the dull zone will be resonant. Percussion from the now resonant flank to the midline will reveal that the dull zone has shifted. More than 500-1100 ml of fluid should be present in the peritoneal cavity for proper demonstration of sifting dullness (USG can detect as little as 100 ml of peritoneal fluid).[20,21] Trying to demonstrate ascites with a lesser quantity of fluid in the indecent knee-elbow position (puddle sign) is discouraged.

It is important to note here that in abdominal distension due to a huge ovarian cyst, the flanks are resonant while the midline is dull, the umbilicus is vertical and pushed upwards and usually, it is not possible to "get below" the swelling.18 In ascites the umbilicus is transverse and pushed down or there may be an umbilical hernia.

Percussion helps to determine the liver span. Percussion down the right side of the chest along MCL delineates the liver dullness (between the resonant zone above due to air-filled lung, to the tympanitic area below due to gas-filled intestine). The normal liver span is around 12cm.

The upper border of liver dullness is in the 5^{th} intercostal space along the right MCL. Obliteration of normal liver dullness suggests pneumoperitoneum (also

occurs in massive right-sided pneumothorax or severe emphysema).

Obliteration of Traube's space (a semilunar resonant area overlying the gastric air bubble) favors splenomegaly or pleural effusion.[20–22]

In splenomegaly, the percussion note at the lowest left intercostal space(8^{th} or 9^{th}) in the anterior axillary line (Castell's point) becomes dull in full inspiration (normally resonant).[20,23]

Resonant note within a solid organ or mass indicates the possibility of it originating from the gut or there being an underlying abscess.

Pain on light percussion is a good method of demonstrating rebound tenderness.

The presence of a dull percussion note in both flanks which remains constant on the left side but shifts with a change of position on the right flank is suggestive of a ruptured spleen (Balance sign).[13]

6. Auscultation

Some clinician prefers the percussion to be performed after inspection to avoid stimulating or depressing the bowel movements thereby altering the characteristics of the bowel sounds.[3]

6.1. Bowel sounds

The presence of gas and fluid in the actively moving intestine produce the gurgling bowel sounds, audible with the diaphragm of the stethoscope placed to the right of the umbilicus. Normally every 5-10 seconds low-pitched gurgling bowel sounds should be audible. The absence of the same over 30 seconds suggests the possibility of paralytic ileus (peritonitis, post-operative, hypokalemia, uremia), while frequent, prolonged, loud low pitched gurgles or borborygmi, rising to a crescendo of high-pitched metallic sounds or "tinkles" which progress later to ileus in advanced stages suggests the natural evolvement of mechanical bowel obstruction. In post-operative abdominal distension, bowel sounds help to differentiate between ileus and early small bowel obstruction.[18]

6.2. Bruits

Medium or low-pitched systolic bruits may be audible in 4-20% of healthy individuals.[24] Turbulent blood flow in high flow arteries with aneurysm or stenosis or in arteriovenous fistulae produces systolic/diastolic bruit.[24] It is best heard with the bell of the stethoscope. Aortic bruit in AAA is heard in the midline at the epigastrium. In mesenteric arterial insufficiency, it is audible in the midline at the trans-pyloric plane (origin of SMA). In renal artery stenosis, it is audible a few centimeters above the umbilicus by the side of the rectus and in the same lateral positions, a few centimeters below the umbilicus in the iliac artery stenosis. It is also audible on the left in patients with splenomegaly with dilated or tortuous splenic artery and right upper quadrant in patients with vascular hepatic malignancies.

6.3. Succussion splash

The lower rib cage is held with both hands while the diaphragm of the stethoscope is fixed on the epigastrium with both thumbs. On shaking the patient's torso side to side with both hands, a splashing sound is audible in patients with gastric outlet obstruction even after fasting for 4 hours (also audible in late intestinal obstruction with paralytic ileus).[25]

6.4. Ausculto-percussion (Scratch Test)

This maneuver helps in detecting distended stomach in pyloric stenosis. The diaphragm of the stethoscope is placed over the epigastrium and the upper part of the abdomen is scratched radially with a pencil in a centrifugal fashion. The points where there is a change in the note are marked. Joining these points gives the outline of the greater curvature of the distended stomach reaching below the umbilicus.[10,20,26]

6.5. Abdominal examination is not complete without an examination of

1. Hernial orifices / inguinal lymph nodes/ femoral pulses: groin hernia, enlarged inguinal nodes, peripheral occlusive arterial disease.
2. Neck nodes: Palpable, left supra-clavicular lymph node (Virchow's node) due to metastasis from upper abdominal malignancy (Troisier's sign).
3. External genitalia — testicular atrophy along with spider angiomata, palmar erythema, caput medusae, and gynecomastia are the peripheral stigmata of chronic liver disease.
4. Digital rectal examination

7. Conclusions

Though diseases of the abdominal organs can often have overlapping physical findings an astute clinician by meticulous examination of the abdomen can gather clues to most of the diseases giving rise to abdominal symptoms and arrive at a provisional diagnosis confidently. Even when an accurate diagnosis eludes the surgeon even after a thorough abdominal examination, he can focus his attention and plan appropriate investigations to obtain information that the clinical examination could not reveal. Moreover, the act of history taking and gentle physical examination is vital in establishing a healthy bond with the patient.[27]

8. Source of Funding

None.

9. Conflict of Interest

None.

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Cite this article: Bhattacharjee PK. Abdominal examination: Invaluable clinical findings and their interpretations. *IP J Surg Allied Sci* 2022;4(4):126-131.