

TRANSABDOMINAL BOWEL ULTRASOUND AS A METHOD OF PRIMARY DIAGNOSIS IN ACUTE BOWEL PATHOLOGY: LITERATURE REVIEW AND DEMONSTRATION OF CLINICAL CASES

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Abstract

Currently, transabdominal ultrasound of the bowel is rarely used in daily routine practice to assess bowel condition due to the difficulty of its visualization, lack of awareness of specialists, and also due to the limited number of specialists who know the technique of bowel examination.

Patients with acute bowel pathology seek emergency care in more than one third of cases. Gastrointestinal ultrasound is often used as the first imaging modality with good diagnostic accuracy in the setting of acute abdomen and may be the optimal diagnostic strategy in young women because of the radiation burden associated with X-ray and computer tomography scan. The clinician can examine the gastrointestinal tract in the area of greatest pain using ultrasound, thus obtaining more information and pathology data than standard physical examination.

Intestinal ultrasound is mainly used for the diagnosis and monitoring of patients with inflammatory bowel disease, which helps to avoid the frequent use of invasive and expensive diagnostic procedures and leads to the early implementation of suitable treatment. This method can also serve to detect other pathological conditions present in the gastrointestinal tract. It is a promising method with high sensitivity and specificity, which has the advantage of being easily accessible, non-invasive, safe, due to the absence of ionising radiation and the need to use contrast agents.

In addition, the advantage of this method is the reduction of diagnostic search, which allows the doctor to establish the diagnosis in a shorter time, as well as to reduce the patient's expenses for expensive examinations.

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Ішектің жедел патологиясының бастапқы диагностикалық әдісі ретінде ішектің трансабдоминальды ультрадыбыстық зерттеуі: әдеби шолу және клиникалық жағдайларды көрсету

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Түйіндеме

Қазіргі уақытта ішектің трансабдоминальды ультрадыбыстық зерттеуі ішектің жай-күйін бағалау үшін күнделікті тәжірибеде оны визуализациялаудың күрделілігіне, мамандардың хабардар болмауына байланысты, сондай-ақ ішекті тексеру әдістемесімен таныс мамандар санының шектеулі болуына байланысты сирек қолданылады.

Ішектің жедел патологиясы бар науқастардың үштен бірінен астамы шұғыл көмекке жүгінеді. Асқазан-ішек жолдарының ультрадыбыстық зерттеуі жедел іш жағдайында жақсы диагностикалық

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Түйінді сөздер:

ішектің ультрадыбыстық зерттеуі,
аш ішек, тоқішек, ішектің инвазивті
емес диагностикасы

дәлдікпен бейнелеудің бірінші әдісі ретінде жиі қолданылады және, рентгенмен компьютерлік томографияның сәулелік жүктемесіне байланысты, жас әйелдерде оңтайлы диагностикалық стратегия болуы мүмкін. Дәрігер ультрадыбысты қолдану арқылы асқазан-ішек жолдарын қатты ауырсыну аймағында тексерелеады, осылайша стандарты физикалық тексеруденгөрі патологиялық аймақ туралы көбірек ақпаратпен деректер алады.

Ішектің ультрадыбыстық зерттеуінегізінен ішектің қабыну аурулары бар науқастарды диагностикалау және бақылау үшін қолданылады, бұл инвазивті және қымбат диагностикалық процедураларды жиі қолданудан аулақ болуға көмектеседі және қолайлы емдеуді ерте жүргізуге әкеледі. Бұл әдіс асқазан - ішек жолынд аболатын басқа патологиялық жағдайларды анықтауға да қызмет етуі мүмкін. Бұл жоғары сезім талдықпен арайылыққы ие перспективалық әдіс, оның артықшылығы қолжетімділігінде, инвазивті емес тігінде және, иондаушы сәулелену мен контрасты заттарды қолдану қажет еместігіне байланысты, қауіпсіз болып табылатындығы.

Соныменқатар, бұл әдістің артықшылығы диагностикалық іздеуді азайтады, бұл дәрігерге қысқа мерзімде диагноз қоюға мүмкіндік береді, сонымен қатар пациенттің қымбат зерттеулерге жұмсалатын шығындарын шектеуге мүмкіндікбереді.

Трансабдоминальное ультразвуковое исследование кишечника, как метод первичной диагностики при острой патологии кишечника: литературный обзор и демонстрация клинических случаев

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Аннотация

Ключевые слова:
ультразвуковое исследование
кишечника, тонкая кишка,
толстая кишка, неинвазивная
диагностика кишечника

В настоящее время трансабдоминальное ультразвуковое исследование кишечника редко используется в повседневной рутинной практике для оценки состояния кишечника из-за сложности его визуализации, недостаточной осведомленности специалистов, а также ввиду ограниченного числа специалистов, владеющих методикой осмотра кишечника.

Пациенты с острой патологией кишечника более чем в трети случаев обращаются за неотложной помощью. Ультразвуковое исследование желудочно-кишечного тракта часто используется в качестве первого метода визуализации с высокой диагностической точностью в условиях острого живота, является оптимальной диагностической стратегией у молодых женщин из-за низкой лучевой нагрузки, в сравнении с рентгеном и компьютерной томографией. Врач может обследовать желудочно-кишечный тракт в зоне наибольшей болезненности с помощью ультразвука, получая, таким образом, больше информации и данных о патологии, чем при стандартном физикальном обследовании.

Ультразвуковое исследование кишечника в основном используется для диагностики и наблюдения за пациентами с воспалительными заболеваниями кишечника, что помогает избежать частого использования инвазивных и дорогостоящих диагностических процедур и приводит к раннему осуществлению подходящего лечения. Этот метод может служить для выявления других патологических состояний, присутствующих в желудочно-кишечном тракте. Это перспективный метод, обладающий высокой чувствительностью и специфичностью, преимуществом которого является легкая доступность, неинвазивность, безопасность, ввиду отсутствия ионизирующего излучения и потребности в использовании контрастных веществ. Преимущество данного метода заключается в сокращении диагностического поиска, что позволяет врачу сократить сроки установить диагноза и затраты пациента на дорогостоящие обследования.

Introduction

Both low- and high-resolution transducers are required for a complete bowel examination. The method of scanning to assess the bowel may vary depending on the clinical problem: the

examination tactics, for example, will differ for abdominal trauma, suspected bowel obstruction or appendicitis and chronic complaints such as prolonged diarrhea. For surgical conditions, a more rapid targeted approach is used, whereas

for suspected chronic bowel pathology, a full systematic gastrointestinal scan is performed. There are no comparative studies comparing one method of gastrointestinal scanning with another, and these recommendations are largely a matter of expert opinion.^{1,2}

Pathological conditions.

In intestinal ultrasound, the most frequent pathological findings are thickening of the intestinal wall, changes in the echo pattern of the intestinal wall, hyperaemia of the intestinal wall, decreased elasticity and peristalsis, hypertrophy of mesenteric fatty tissue, enlargement of lymph nodes and the presence of abdominal free fluid.³

Appendicitis

Acute appendicitis is one of the most frequent abdominal emergencies worldwide, with an incidence of approximately 100 per 100.000 person-years and a lifetime prevalence of 7-8%.^{3,4}

Since several studies have demonstrated a marked reduction in the incidence of negative laparotomy findings when abdominal ultrasound is used preoperatively,⁴ recent guidelines recommend the routine use of gastrointestinal ultrasound in every patient with suspected appendicitis.⁵ Indeed, the sensitivity and specificity of bowel ultrasound performed by experienced professionals exceeds 90%, equivalent to computed tomography (CT) or magnetic resonance (MRI), with the advantage of wide availability, non-invasiveness and absence of ionising radiation.⁶

The role of bowel ultrasound in suspected acute appendicitis is to confirm the diagnosis or rule it out by demonstrating a normal appendix along its entire length, and to rule out an alternative cause of abdominal pain.⁵ Moreover, bowel ultrasound can differentiate between uncomplicated and complicated appendicitis, as non-surgical treatment of uncomplicated appendicitis is recommended.⁶

In clinical practice, only a combination of various intestinal ultrasound findings allows the diagnosis of acute appendicitis. The detection of an appendix with thickened walls and hyperechogenic periappendicular tissue over the area of greatest pain are the most significant criteria in confirming the diagnosis, while mesenteric lymphadenopathy and color Doppler evaluation of the appendix are not specific signs and may be seen in a number of conditions.³ (Case 1).

Intestinal intussusception

Intestinal intussusception occurs when one segment of intestine retracts into a neighboring segment of intestine, causing obstruction and even intestinal ischaemia.⁷

Intestinal intussusception is the leading cause of intestinal obstruction in children, but in adults it accounts for only 5% of

all intussusceptions and 0.003-0.02% of all adult hospitalizations. Unlike pediatric intussusception, which is idiopathic in 90% of cases, intussusception in adults has a distinct leading point that represents a well-defined pathological abnormality in 70-90% of cases.⁸

The symptoms of intussusception in adults are so nonspecific that a clinical diagnosis beyond intestinal obstruction is rarely made preoperatively.⁸

Ultrasonography is considered a useful tool for the diagnosis of intussusception in both children and adults.⁹

Classic ultrasonographic features include "target" or "donut" signs visible in transverse section and "pseudo-bulb" signs visible in longitudinal. Ultrasound has several disadvantages, two of which include masking of identifiable features by gas-filled bowel loops and operator dependence.⁷

The association between intestinal intussusception in adults and celiac disease has been described previously and has not yet been widely recognized.

Interestingly, a 2016 World Journal of Gastrointestinal Surgery article described intestinal intussusception as the initial manifestation of celiac disease in 57% of American adults.¹⁰

Intestinal intussusception in adults is a rare condition whose cause should be carefully investigated to expedite treatment and prevent unnecessary surgical intervention.¹¹

In general, ultrasound has a sensitivity of 98-100% and specificity of 88-89% for the diagnosis of intestinal intussusception. Abdominal CT is currently considered the most sensitive radiological method to confirm intussusception with a diagnostic accuracy of 58-100%.¹² (Case 2).

Intestinal obstruction

Intestinal obstruction is a frequent cause of acute abdominal pain leading to hospitalization in the emergency department. Small intestinal obstruction accounts for approximately 80% of mechanical intestinal obstruction cases. Colonic obstruction is 4-5 times less common and in most cases is caused by colorectal tumours.³

The clinical presentation of intestinal obstruction depends on the localization and cause of the obstruction and often includes abdominal pain, nausea, vomiting, cessation of gas and/or stool discharge and abdominal bloating. Indeed, the clinical picture is non-specific and imaging is mandatory to confirm the diagnosis and distinguish between mechanical and functional small bowel obstruction, to determine the location and cause of obstruction, and to assess the risk of complications (bowel ischaemia) and the feasibility of non-surgical treatment (1).

Among the available imaging modalities, gastrointestinal ultrasound shows similar accuracy to CT (sensitivity 87%, specificity 81%) and higher than X-ray in detecting small bowel obstruction.¹³

Indeed, given its well-known advantages, ultrasound is recommended as the first screening method to detect the presence of intestinal obstruction.¹⁴ Otherwise, the reliability of ultrasound for determining the location and cause of obstruction is lower than CT, so it may be appropriate to combine the two methods.¹⁵

Sonographic findings of bowel obstruction include dilated, fluid-filled loops of bowel with hyperechogenic patches of gas moving within the fluid. These dilated loops may have a thickened wall, usually up to 3 mm, thickened circumferential folds and increased "back and forth" movement of bowel contents.¹⁶ (Case 3).

The aim of this review article is to present the current capabilities of transabdominal ultrasound in the evaluation of the most common and important surgical conditions in bowel pathology, and to present our own results of echographic imaging of the bowel.

Materials and methods

The recruitment of patients was carried out at the Research Institute of Cardiology and Internal Diseases, Department of Functional and Ultrasound Diagnostics. Patients (inpatient and outpatient) were sent on an accelerated basis for

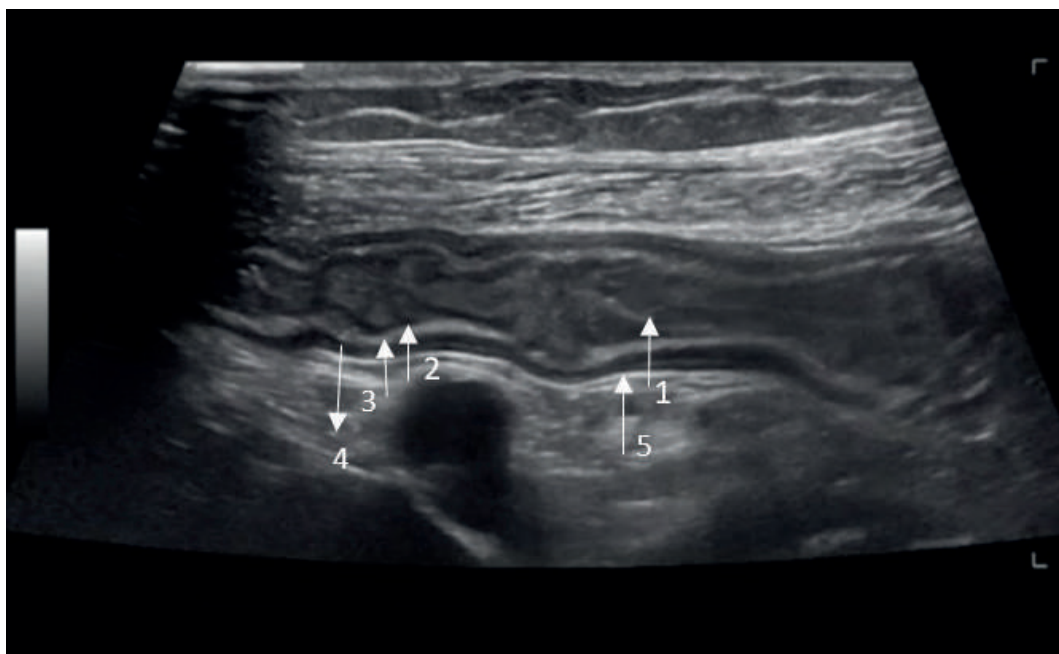
transabdominal ultrasound examination of the intestine with symptoms of acute abdominal pain against the background of chronic pathology of the gastrointestinal tract (2 patients with Crohn's disease and 1 with celiac disease).

The study was performed on an ultrasound device - Philips Affinity 70, manufactured in 2021.

During transabdominal ultrasound examination, a curvilinear low frequency probe was used to obtain a systematic scan of the intestine, then for a more detailed examination of the intestinal wall, the examination was carried out with a linear high-frequency probe.

Ultrasound anatomy of the intestine. Normally, the intestinal wall consists of five sonographic layers when examined with a high-frequency transducer (above 5 MHz). The sonographic layers do not exactly correspond to the histological layers, thus representing a combination of the interface echo signals of the histological layers. Starting from the lumen, the first layer (hyperechogenic) is the interface between the mucosa and the lumen, the second layer (hypoechoic) to the mucosa, the third layer (hyperechogenic) to the submucosa, the fourth layer (hypoechoic) to the muscularis and the fifth layer (hyperechogenic) to the echo interface between the muscularis and serosa.³ (Figure 1).

Figure 1.
Normal echogram of the small intestine. The image was obtained using a high-frequency linear transducer. 1 - superficial (boundary) echogenic layer; 2 - mucosa; 3 - submucosa; 4 - muscularis; 5 - serosa.



Case presentation 1

A patient with Crohn's disease in remission for a year complained of pain in the right iliac region. The general blood analysis revealed: leukocytosis, neutrophilosis, acceleration of erythrocyte sedimentation rate. An exacerbation

of Crohn's disease was suspected, in connection with which the patient was referred for intestinal ultrasound, which revealed signs of acute appendicitis and no evidence of Crohn's disease exacerbation (Figure 2).

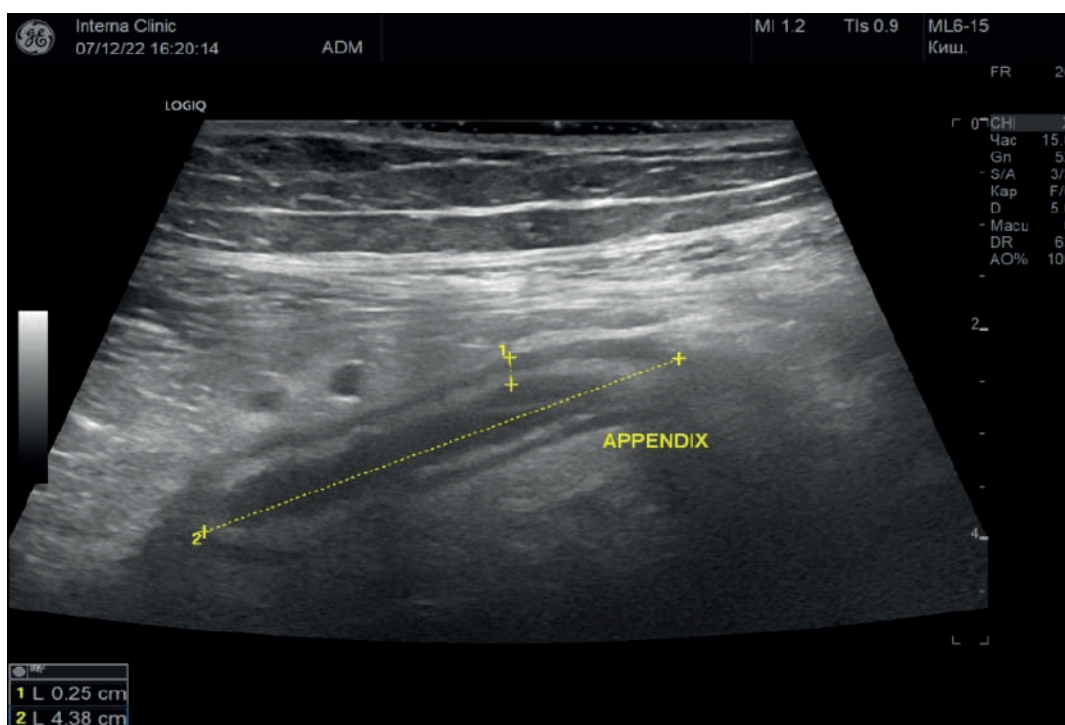


Figure 2. Longitudinal scan of the appendix showing thickened walls and hyperechoic periappendiceal tissue (hypertrophy of mesenteric fat), tissue (hypertrophy of mesenteric fat); compression with the probe does not allow the lumen to contract, and this manoeuvre causes localized pain in the patient.

Presentation case 2. Intestinal intussusception

A 38-year-old female patient presented with complaints of liquid stools up to 2 times a day, without pathological impurities, abdominal

bloating and pain predominantly in the right iliac region, history of celiac disease for 6 years, without following a strict gluten-free diet (Figure 3).



Figure 2. Intussusception with typical appearance of concentric rings of thickened intestinal wall of different echogenicity "target symptom" was detected in the right iliac fossa.

Presentation case 3. Intestinal obstruction

An 18-year-old female patient complained of abdominal pain after eating, vomiting after eating food, regular stools alternating with constipation for 3 days.

She was referred for intestinal ultrasound, which revealed signs of colonic obstruction (Figure 4), further confirmed by abdominal CT scan (Figure 5).

Figure 4.

In practically all parts of the abdominal cavity, dilated to d - 5.86 cm. loops of the colon are visualised, with a large amount of heterogeneous fluid content in the lumen, with sluggish pendulous peristalsis.

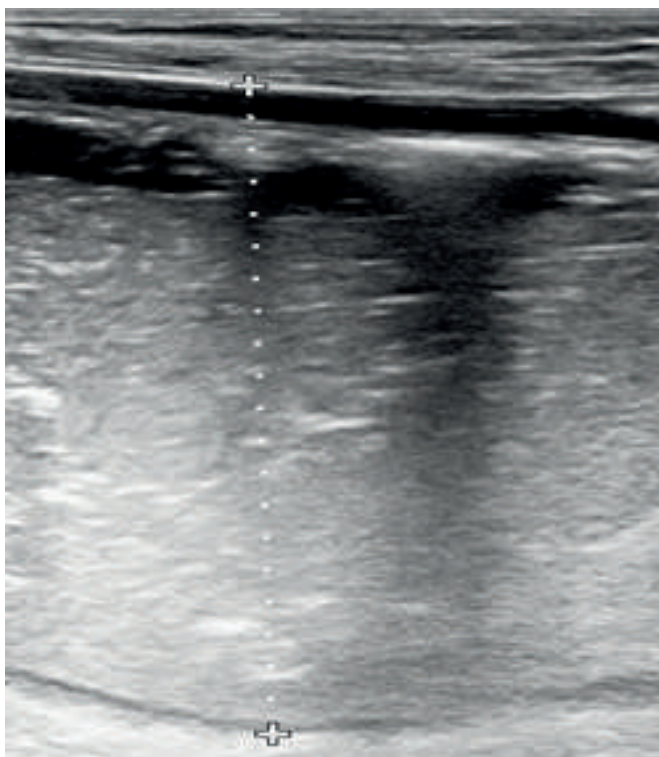
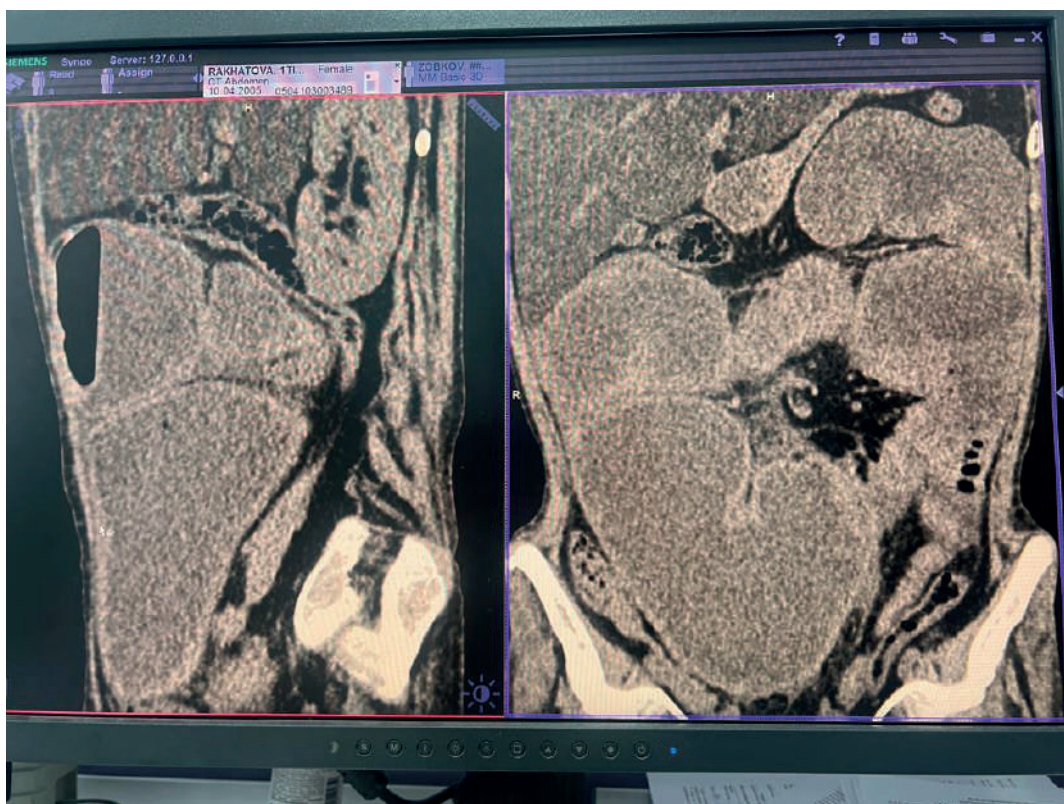


Figure 5.

CT image of the abdominal organs of this patient with signs of acute intestinal obstruction. Severely swollen loops of the large intestine with a fluid level are visualized.



Conclusions

Intestinal ultrasound, allows the diagnosis of the vast majority of both acute and chronic intestinal pathologies. Sonography plays a vital role in the detection of acute gastrointestinal

pathology and should be used more frequently in daily clinical practice due to its accessibility, portability, cost-effectiveness and absence of ionising radiation.

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