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METEORIZAM I ABDOMINALNA DISTENZIJA

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Sažetak: Meteorizam ili nadimanje u trbuhu i abdominalna distenzija-nadutost su među najčešćim problemima u vezi sa organima za varenje koje pacijenti imaju i na primarnom i na sekundarnom nivou. Čak 10-30% opšte populacije ima probleme sa nadimanjem. Simptomi se još češće javljaju kod pacijenata sa funkcionalnim oboljenjima gastrointestinalnog trakta. Nadutost je često povezana sa osećajem povećanog pritiska u trbuhu i ispuštanjem gasova iz creva. Zdrava osoba može tolerisati do 500 ml vazduha u gastrointestinalnom traktu bez većih simptoma, ali kod pacijenata sa sindromom iritabilnog creva simptomi su uzrokovani čak i minimalnim povećanjem zapremine gasova u gastrointestinalnom traktu. Sastav crevnih gasova donekle objašnjava i njihov nastanak: azot-N₂, je obično poreklom iz progutanog vazduha; vodonik-H₂, nastaje bakterijskom fermentacijom ugljenih hidrata; ugljendioksid-CO₂ nastaje bakterijskom fermentacijom ugljenih hidrata, masti i proteini; metan-CH₄, se proizvodi tokom anaerobnog metabolizma bakterija [6]. Kada se poremeti ravnoteža između proizvodnje i izlučivanja gasova u digestivnom sistemu, to se manifestuje osećajem nadimanje sa ili bez vidljive nadutosti trbuha. Prilikom definisanja funkcionalnih poremećaja povezanih sa nadimanjem, veoma je važno isključiti moguće organske uzroke simptoma. I nadimanje i nadutost trbuha se povremeno javljaju čak i kod zdravih osoba kao rezultat normalnog varenja (naročito nakon obroka hrane bogate mastima i fermentišućim šećerima). Karakteristika "fizioloških" nadimanja i distenzije je da se pojavljuju ubrzo nakon obroka, kratkotrajni su i nestaju nakon mokrenja ili izbacivanja gasova. U početku su nadimanje i nadutost u trbuhu shvatani samo kao posledice prevelike količine vazduha u crevima. Danas znamo da je patofiziologija oba stanja mnogo složenija i da je rezultat različitih mehanizama. Pored pojačanog stvaranja gasova, koji se akumulira u crevima zajedno sa tečnošću, značajan uticaj imaju i izmenjena crevna mikrobiota i funkcionalno izmenjen enterični nervni sistem, koji je uzrok visceralne hiperalgezije i poremećaja motiliteta. Epidemiološka dimenzija i brojni uzroci, uključujući maligne, ukazuju na potrebu za ovakvim vidom dijagnostičkog tretmana pacijenata sa meteorizmom. Dijagnostika se može povezati sa mnogim testovima – uključujući i invazivne, koji mogu predstavljati određeni rizik za pacijenta i finansijski teret za zdravstveni sistem. Zbog toga je neophodan pristup korak po korak i ciljani pristup prilikom obrade svakog pojedinačnog slučaja. Svrha ovog rada je da predstavi postupak lečenja pacijenata sa nadimanjem i da skrene pažnju na najčešća medicinska stanja koja mogu biti uzrok povećane količine gasova u gastrointestinalnom traktu.

Ključne reči: meteorizam, nadutost, gastrointestinalni trakt, dijagnostika

Uvod:

Primarna karakteristika meteorizma je nakupljanje gasova u gastrointestinalnom (GI) traktu što izaziva osećaj nadimanja i nadutosti trbuha-abdominalne distenzije. Meteorizam i abdominalna distenzija su među najčešćim problemima u vezi sa organima za varenje koje pacijenti imaju i na primarnom i na sekundarnom nivou. Meteorizam je veoma čest simptom koji se javlja kod ljudi svih uzrasta. Podjednako je rasprostranjen u svim rasama i može biti prisutan kod beba kao i kod starijih osobe. Oko 15-23% Azijata i 15-30% Amerikanaca pati od nadimanja [1,2]. U Sloveniji

oko 10-30% opšte populacije ima probleme sa nadimanjem [3].

Na ovaj problem je svojevremeno u svom Kanonu medicine ukazivo i antički lekar iz persije Avicena (Avicenna, Ibn Sima). Avicena koristi ključne reči: nadimanje i gasovi a uzroci nadimanja, prema njemu, uključuju uzroke ishrane, neprikladan način života, gastrointestinalne i druge razloge. Štaviše Avicena klasifikuje uzroke na osnovu mesta nastanka na gornji deo trbuha (želudac) i crevni deo trbuha. Takođe, naveo je 38 lekovitih biljaka koje se koriste kao lekovi. Savremeni naučni podaci podržavaju većinu uzroka nadimanja koji

METEORISM AND ABDOMINAL DISTENSION

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Summary: Meteorism or bloating in the abdomen and abdominal distension are among the most common digestive issues that patients experience at both primary and secondary care levels. Up to 10-30% of the general population experiences bloating problems. Symptoms are even more prevalent in patients with functional gastrointestinal disorders. Bloating is often associated with a feeling of increased pressure in the abdomen and the release of gas from the intestines. A healthy individual can tolerate up to 500 ml of air in the gastrointestinal tract without major symptoms, but in patients with irritable bowel syndrome, symptoms can be triggered by even minimal increases in gas volume in the gastrointestinal tract. The composition of intestinal gases partly explains their origin: nitrogen (N₂) is usually from swallowed air; hydrogen (H₂) is produced by bacterial fermentation of carbohydrates; carbon dioxide (CO₂) is produced by bacterial fermentation of carbohydrates, fats, and proteins; methane (CH₄) is produced during anaerobic bacterial metabolism. When there is an imbalance between gas production and expulsion in the digestive system, it manifests as a feeling of bloating with or without visible abdominal distension. When defining functional disorders related to bloating, it is crucial to exclude possible organic causes of symptoms. Bloating and abdominal distension occasionally occur even in healthy individuals as a result of normal digestion (especially after meals rich in fats and fermentable sugars). The characteristic of "physiological" bloating and distension is that they occur shortly after meals, are short-lived, and disappear after urination or passing gas. Initially, bloating and abdominal distension were only understood as consequences of excessive air in the intestines. Today, we know that the pathophysiology of both conditions is much more complex and the result of different mechanisms. In addition to increased gas production, which accumulates in the intestines along with fluid, altered intestinal microbiota and functionally altered enteric nervous system, which cause visceral hyperalgesia and motility disorders, also have a significant impact. The epidemiological dimension and numerous causes, including malignancies, indicate the need for this type of diagnostic approach in patients with bloating. Diagnosis can involve many tests, including invasive ones, which may pose a certain risk to the patient and a financial burden on the healthcare system. Therefore, a step-by-step approach and a targeted approach are necessary when managing each individual case. The purpose of this study is to present the treatment approach for patients with bloating and to draw attention to the most common medical conditions that may cause increased gas in the gastrointestinal tract.

Keywords: meteorism, bloating, gastrointestinal tract, diagnostics

INTRODUCTION

The primary characteristic of meteorism is the accumulation of gases in the gastrointestinal (GI) tract, which causes a feeling of bloating and abdominal distension. Meteorism and abdominal distension are among the most common digestive issues that patients experience at both primary and secondary care levels. Meteorism is a very common symptom occurring in people of all ages, equally prevalent in all races, and can be present in both babies and older individuals. Approximately 15-23% of Asians and 15-30% of Americans suffer from

bloating [1,2]. In Slovenia, about 10-30% of the general population have bloating problems [3].

This issue was highlighted in the past by the Persian physician Avicenna in his Canon of Medicine. Avicenna used keywords such as bloating and gases, attributing the causes of bloating to dietary factors, inappropriate lifestyle, gastrointestinal, and other reasons. Furthermore, Avicenna classified the causes based on the location of origin, dividing them into the upper part of the abdomen (stomach) and the intestinal part of the abdomen. He also listed 38 medicinal plants used as remedies. Modern scientific data support most of the

su pomenuti u Aviceninom Kanonu [4].

Simptomi meteorizma se još češće javljaju kod pacijenata sa funkcionalnim oboljenjima gastrointestinalnog trakta [5]. Meteorizam je skoro redovno povezan sa simptomima u vidu nadimanja, nadutosti i ispuštanje gasova iz creva. Uzroci meteorizma su obično benigni, kao što je prejedanje, gutanje vazduha tokom jela ili prekomerna fermentacija u crevnoj mikrobioti. Uzroci koji više zabrinjavaju mogu uključivati opstrukciju creva, bubrežne kamence, funkcionalne poremećaje vezane za prejedanje, prekomerni rast bakterija, inflamatorne bolesti creva, nepodnošenje pojedinih supstanci hrane, alergiju, tupu traumatu solidnih organa abdomena, peritonitis i idiopatske uzroke.

Prilikom definisanja funkcionalnih poremećaja povezanih sa nadimanjem, veoma je važno isključiti moguće organske uzroke simptoma uključujući i maligne.

Dijagnostika se može povezati sa mnogim testovima – uključujući i invazivne, koji mogu predstavljati određeni rizik za pacijenta i finansijski teret za zdravstveni sistem. Zbog toga je neophodan korak po korak u dijagnostici i ciljani pristup prilikom lečenja pacijenata [3].

Meteorizam i distenzija trbuha – definicija pojmova Meteorizam, nadimanje i nadutost su različiti termini koji se koriste za opisivanje istog stanja: povećane količine gasova u digestivnom traktu. Meteorizam je stručni naziv za ovu pojavu, dok su nadimanje i nadutost termini češći u narodu. Nadimanje se odnosi na osećaj napetosti ili punoće u trbuhu, a nadutost na vidljivo povećanje obima trbuha. Flatulencija je još jedan stručni izraz koji označava ispuštanje gasova iz anusa.

Kod zdravog pojedinca u gastrointestinalnom traktu se obično nalazi 100 do 200 ml gasova, što je fiziološki i odraz je dinamičkog procesa stvaranja gasova u procesu varenja. Gasovi mogu ući u gastrointestinalni trakt tokom hranjenja (aerofagija), nastaju u procesu raspadanja supstanci i bakterijske fermentacije. Uklanjaju se tokom defekacije, difuzijom gasova iz creva u sistemsku cirkulaciju, a neki gasovi su neophodni za metabolizam crevne mikrobiote. Osim što izazivaju neugodnost, crevni gasovi mogu biti povezani sa ozbiljnijim simptomima. U crevnoj mikrobioti bakterije *Bacteroides*, *Ruminococcus*, *Roseburia*, *Clostridium*, *Eubacterium*, *Desulfovibrio* i *Methanobrevibacter* spadaju među

najzastupljenije mikrobe odgovorne za nastanak crevnih gasova. Više od 99% crevnog gasa se sastoji od vodonika, ugljendioksida i metana, dok se manje od 1% sastoji od drugih mirisnih jedinjenja. Grupe hrane povezane sa crevnim gasovima uključuju mahunarke, povrće, voće, žitarice i, za neke pojedince, mlečne proizvode. Ova hrana je bogata nesvarljivim ugljenim hidratima kao što su oligosaharidi porodice rafinoza, fruktani, polioli i za osetljive osobe, laktoza. Ove ugljene hidrate fermentišu bakterije debelog creva i proizvode gasove direktno ili unakrsnom fermentacijom [8].

Sastav crevnih gasova donekle objašnjava i njihov nastanak: azot-N₂, je obično poreklom iz progutanog vazduha; vodonik-H₂, nastaje bakterijskom fermentacijom ugljenih hidrata; ugljendioksid-CO₂ nastaje bakterijskom fermentacijom ugljenih hidrata, masti i proteini; metan-CH₄, se proizvodi tokom anaerobnog metabolizma bakterija [6]. Kada se poremeti ravnoteža između proizvodnje i izlučivanja gasova u digestivnom sistemu, to se manifestuje osećajem nadimanje sa ili bez vidljive nadutosti trbuha. Zdrava osoba može tolerisati do 500 ml vazduha u gastrointestinalnom traktu bez većih simptoma, ali kod pacijenata sa sindromom iritabilnog creva simptomi su uzrokovani čak i minimalnim povećanjem zapremine gasova u gastrointestinalnom traktu [6,7].

Meteorizam (nadimanje) je simptomu koji pacijenti opisuju kao osećaj povećanog pritiska u trbušnoj duplji. Istovremeno se može pridružiti i nadutost trbuha, pri čemu nalazimo objektivno povećan volumen abdomena; međutim, abdominalna distenzija se može javiti i kao nezavisan znak [8,9]. I nadimanje i nadutost trbuha se povremeno javljaju čak i kod zdravih osoba kao rezultat normalnog varenja (naročito nakon obroka hrane bogate mastima i fermentišućim šećerima). Karakteristika "fizioloških" nadimanja i distenzije je da se pojavljuju ubrzo nakon obroka, kratkotrajni su i nestaju nakon mokrenja ili izbacivanja gasova [8]. U početku su nadimanje i nadutost u trbuhu shvatani samo kao posledice prevelike količine vazduha u crevima. Danas znamo da je patofiziologija oba stanja mnogo složenija i da je rezultat različitih mehanizama. Pored pojačanog stvaranja gasova, koji se akumulira u crevima zajedno sa tečnošću, značajan uticaj imaju i izmenjena crevna mikrobiota i funkcionalno izmenjen enterični nervni sistem, koji je uzrok visceralne hiperalgezije i poremećaja motiliteta

causes of bloating mentioned in Avicenna's Canon [4].

Symptoms of meteorism are even more prevalent in patients with functional gastrointestinal disorders [5]. Meteorism is almost invariably associated with symptoms such as bloating, distension, and the passage of gas from the intestines. The causes of meteorism are usually benign, such as overeating, swallowing air during meals, or excessive fermentation in the intestinal microbiota. More concerning causes may include bowel obstruction, kidney stones, functional disorders related to overeating, bacterial overgrowth, inflammatory bowel diseases, food intolerance, allergies, blunt trauma to solid abdominal organs, peritonitis, and idiopathic causes.

When defining functional disorders related to bloating, it is crucial to exclude possible organic causes of symptoms, including malignancies.

Diagnosis can involve many tests, including invasive ones, which may pose a certain risk to the patient and a financial burden on the healthcare system. Therefore, a step-by-step approach and targeted treatment approach are necessary [3].

Meteorism and abdominal distension - definition of terms:

Meteorism, bloating, and distension are different terms used to describe the same condition: increased gas in the digestive tract. Meteorism is the medical term for this condition, while bloating and distension are more common terms in everyday language. Bloating refers to a feeling of tightness or fullness in the abdomen, while distension refers to a visible increase in abdominal girth. Flatulence is another medical term that refers to the passage of gas from the anus.

In a healthy individual, the gastrointestinal tract usually contains 100 to 200 ml of gas, which is physiological and reflects the dynamic process of gas formation during digestion. Gases can enter the gastrointestinal tract during feeding (aerophagia), arise from the breakdown of substances and bacterial fermentation. They are eliminated during defecation, through the diffusion of gases from the intestines into the systemic circulation, and some gases are necessary for the metabolism of the intestinal microbiota. In addition to causing discomfort, intestinal gases can be associated with more serious symptoms. In the intestinal

microbiota, bacteria such as Bacteroides, Ruminococcus, Roseburia, Clostridium, Eubacterium, Desulfovibrio, and Methanobrevibacter are among the most common microbes responsible for the formation of intestinal gases. More than 99% of intestinal gas consists of hydrogen, carbon dioxide, and methane, while less than 1% consists of other odorous compounds. Food groups associated with intestinal gases include legumes, vegetables, fruits, cereals, and for some individuals, dairy products. This food is rich in indigestible carbohydrates such as oligosaccharides of the raffinose family, fructans, polyols, and for sensitive individuals, lactose. These carbohydrates are fermented by colonic bacteria, producing gases directly or through cross-fermentation [8].

The composition of intestinal gases partly explains their origin: nitrogen (N₂) is usually from swallowed air; hydrogen (H₂) is produced by bacterial fermentation of carbohydrates; carbon dioxide (CO₂) is produced by bacterial fermentation of carbohydrates, fats, and proteins; methane (CH₄) is produced during anaerobic bacterial metabolism. When there is an imbalance between gas production and expulsion in the digestive system, it manifests as a feeling of bloating with or without visible abdominal distension. A healthy individual can tolerate up to 500 ml of air in the gastrointestinal tract without major symptoms, but in patients with irritable bowel syndrome, symptoms can be triggered by even minimal increases in gas volume in the gastrointestinal tract [6,7].

Meteorism (bloating) is a symptom that patients describe as a feeling of increased pressure in the abdominal cavity. Simultaneously, abdominal distension may accompany it, wherein we find an objectively increased volume of the abdomen; however, abdominal distension can also occur as an independent sign [8,9]. Bloating and abdominal distension occasionally occur even in healthy individuals as a result of normal digestion (especially after meals rich in fats and fermentable sugars). The characteristic of "physiological" bloating and distension is that they occur shortly after meals, are short-lived, and disappear after urination or passing gas. Initially, bloating and abdominal distension were only understood as consequences of excessive air in the intestines. Today, we know

[9,10].

Patofiziologija funkcionalnih gastrointestinalnih poremećaja sa meteorizmom i abdominalnom distenzijom je multifaktorska i nije u potpunosti shvaćena. Predloženo je nekoliko osnovnih mehanizama koji mogu koegzistirati kod pojedinačnog pacijenta:

1. **Intraluminalni sadržaj creva** (povećana količina gasova i tečnosti)
2. **Visceralna hipersenzitivnost**
3. **Abdominalno-dijafragmalna disinergija** (Umesto opuštanja dijafragme i kontrakcije trbušnih zidova, unošenje hrane dovodi do opuštanja trbušnih zidova i dijafragma se pomera niže i bliže abdomenu). To dovodi do povećanja pritiska u trbušnoj duplji, što može dovesti do meteorizma, bolova, a u nekim slučajevima i zatvora. ADD se često vidi zajedno sa disinergijom mišića karličnog dna),
4. **Opstipacija,**
5. **Gojaznost**
6. **Disbioza** (koja dovodi do hronične do upale a ona potom dovodi do senzorne i motoričke disfunkcije)
7. **Psihogeni komorbiditeti (anksioznost i depresija)** [1,3]

Pristup pacijentu sa meteorozmom

Etiologija meteorizma i abdominalne distenzije je veoma raznolika. Uzroke delimo na organske i funkcionalne. Dijagnostika je često zahtevna, dugotrajna i skupa.

Poznavanje patoloških stanja koja su najčešća važno je za racionalno lečenje pacijenata sa meteorizmom. Pacijenti mogu biti pošteđeni mnogih neprijatnih i potencijalno rizičnih pregleda, a pravilnim prepoznavanjem bolesti i lečenjem može se postići brzo poboljšanje simptoma. Kada se isključuju organski uzroci, posebno moramo paziti na alarmne simptome. (Alarmni simptomi su indikatori mogućih organskih oboljenja i neophodno je da pacijenta pregleda gastroenterolog čim se oni uoče. U njih spadaju: naglo nastala anemija usled krvavljenja iz digestivnog trakta, izraženi neželjeni gubitak telesne mase, perzistentno povraćanje, otežano gutanje i postojanje palpabilne mase u truhu.) Pristup ovih znakova sa nadimanjem trebalo bi da nas usmeri na brzu endoskopsku i slikovnu dijagnostiku, kojom isključujemo moguća značajna organska oboljenja. Inače, endoskopska

i slikovna dijagnostika često malo govore kada se dijagnostikuju uzroci meteorizma funkcionalnog karaktera [7,10,11].

Važna je istorija pacijentovih navika u ishrani. Konzumiranje pojedinačnih velikih obroka i brzo hranjenje mogu izazvati postprandijalno nadimanje. Takvim pacijentima se savetuje da jedu manje obroke, nekoliko puta dnevno. Takođe, određene namirnice mogu izazvati prekomerno nadimanje: luk, mahunarke, kafa, gazirana pića ili voćni šećeri [11]. Posebno ove poslednje navedene namirnice izazivaju mnogo gasova tokom raspadanja, koji su uzrok problema. Ovo saznanje je bilo osnova za danas veoma popularnu „FODMAP“ dijetu. FODMAP dijeta je ishrana koja se koristi za ublažavanje simptoma sindroma iritabilnog creva (SIC), koji uključuje bolove, nadutost, proliv i zatvor. FODMAP je skraćenica za fermentabilne oligosaharide, disaharide, monosaharide i polirole, koje su vrste ugljenih hidrata koje neki ljudi ne mogu dobro svariti. FODMAP dijeta smanjuje unos ovih materija i može pomoći u smanjenju upale i smanjenju količine gasova u crevima. FODMAP dijeta se provodi u tri faze: eliminaciji, reintrodukciji i prilagođavanju. U prvoj fazi se izbacuju sve namirnice bogate FODMAP-om, u drugoj se postupno uvode jedna po jedna kako bi se utvrdilo koje namirnice izazivaju simptome, a u trećoj se prilagođava prehrana na osnovu individualne tolerancije. Efikasnost dijetu u kojoj pacijent izbegava fermentabilne oligo, di i monosaharide i polirole je pokazano u randomizovanim studijama kod pacijenata sa sindromom iritabilnog creva [12,13]. Istorija ishrane je takođe važna za identifikaciju mogućih bolesti koje su posledica štetnog dejstva hrane na gastrointestinalni sistem. Među njima, intolerancija na laktozu je najčešća [14]. Ukoliko se nakon unosa glutena u ishrani javljaju problemi, neophodna je dijagnostika celijakije [15]. Egzokrina insuficijencija pankreasa kod starijih nije tako retka [16].

Nadutost može biti i rezultat određenih lekova i jedan je od neželjenih efekata metformina, a kod opioidnih analgetika javlja se istovremeno i zatvor [11]. U slučaju opstipacije dolazi do poremećenog pražnjenja stolice i gasova koji se potom akumuliraju u digestivnom traktu. Do 80% pacijenata prijavljuje simptome nadimanja kada imaju zatvor. Kod većine pacijenata, simptomi nadimanja će nestati nakon povlačenja opstipacije [17]. U daljem definisanju

that the pathophysiology of both conditions is much more complex and the result of different mechanisms. In addition to increased gas production, which accumulates in the intestines along with fluid, altered intestinal microbiota and functionally altered enteric nervous system, which cause visceral hyperalgesia and motility disorders [9,10].

The pathophysiology of functional gastrointestinal disorders with meteorism and abdominal distension is multifactorial and not fully understood. Several underlying mechanisms have been proposed that may coexist in individual patients:

1. **Intraluminal content of the gut** (increased gas and fluid volume)
2. **Visceral hypersensitivity**
3. **Abdominal-diaphragmatic dysenergia** (Instead of the relaxation of the diaphragm and contraction of the abdominal walls, food intake leads to relaxation of the abdominal walls, and the diaphragm moves lower and closer to the abdomen. This leads to increased pressure in the abdominal cavity, which can lead to meteorism, pain, and in some cases, constipation. ADD is often seen together with pelvic floor muscle disinhibition.)
4. **Constipation**
5. **Obesity**
6. **Dysbiosis** (leading to chronic inflammation, which then leads to sensory and motor dysfunction)
7. **Psychogenic comorbidities** (anxiety and depression) [1,3]

These factors can interact and contribute to the development and persistence of symptoms associated with meteorism and abdominal distension.

Approach to patients with meteorism:

The etiology of meteorism and abdominal distension is highly diverse, categorized into organic and functional causes. Diagnosis is often demanding, prolonged, and costly.

Understanding the most common pathological conditions is essential for the rational treatment of patients with meteorism. Patients can be spared from many unpleasant and potentially risky examinations, and prompt

symptom improvement can be achieved through proper disease recognition and treatment. When organic causes are ruled out, particular attention must be paid to alarm symptoms. (Alarm symptoms are indicators of possible organic diseases, and it is necessary for a gastroenterologist to examine the patient as soon as they are noticed. These symptoms include: sudden onset anemia due to bleeding from the digestive tract, significant unintended weight loss, persistent vomiting, difficulty swallowing, and the presence of a palpable mass in the abdomen.) The presence of these signs with bloating should prompt us to quickly perform endoscopic and imaging diagnostics to rule out potential significant organic diseases. Otherwise, endoscopic and imaging diagnostics often provide little information when diagnosing the causes of functional meteorism [7,10,11g].

Patient dietary habits are important in history taking. Consuming large individual meals and fast eating can cause postprandial bloating. Such patients are advised to eat smaller meals several times a day. Additionally, certain foods can cause excessive bloating: onions, legumes, coffee, carbonated beverages, or fruit sugars [11]. In particular, these latter mentioned foods produce a lot of gas during breakdown, which is the cause of the problem. This knowledge formed the basis for the very popular "FODMAP" diet today. The FODMAP diet is a dietary approach used to alleviate symptoms of irritable bowel syndrome (IBS), which include pain, bloating, diarrhea, and constipation. FODMAP is an acronym for fermentable oligosaccharides, disaccharides, monosaccharides, and polyols, which are types of carbohydrates that some people cannot digest well. The FODMAP diet reduces the intake of these substances and can help reduce inflammation and gas production in the intestines. The FODMAP diet is conducted in three phases: elimination, reintroduction, and adaptation. In the first phase, all high-FODMAP foods are eliminated, in the second phase, they are gradually reintroduced one by one to determine which foods cause symptoms, and in the third phase, the diet is adjusted based on individual tolerance. The effectiveness of a diet avoiding fermentable oligo-, di-, monosaccharides and polyols has been demonstrated in randomized studies in patients with irritable bowel syndrome [12,13]. Dietary history is also important for identifying possible diseases resulting from the harmful effects of

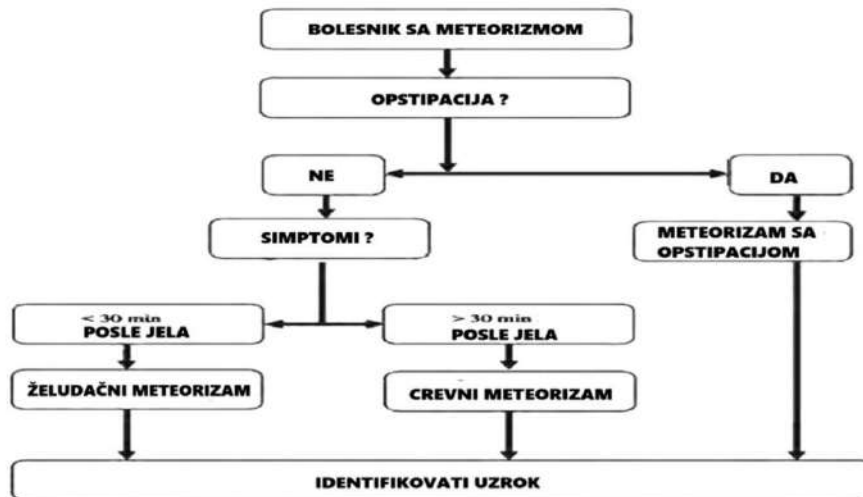
uzroka nadimanja, istorija vremena nastanka problema može biti od pomoći. Ako se tegobe pojave ubrzo nakon hranjenja, uzrok nadimanja je obično u gornjem delu gastrointestinalnog trakta – „želudačno nadimanje ili nadimanje želuca“. Međutim, ako pacijent prijavi nadimanje nakon dužeg vremena od hranjenja, uzrok je obično niži u digestivnom traktu - „crevno nadimanje“.

Ako sažmemo: Kada je prisutan „želudačni“ meteorizam onda najčešće pomislimo na poremećaje pražnjenja želuca, gastroparezu, funkcionalnu dispepsiju, GERB ili bilijarni gastritis. Tada u dijagnostici najčešće koristimo gastroskopiju ili rentgensko snimanje

gornjih partija GIT. Ako je u pitanju „crevni“ meteorizam onda sumnjamo na intolerancija na sastojke hrane, prekomerni rast bakterija-SIBO, celijakija i glutenska senzitivnost, sindrom malapsorpcije, malignome creva, crevne infekcije, ishemiju creva (abdominalna angina), egzokrinu insuficijenciju pankreasa ili funkcionalne bolesti creva. Od dijagnostičkih procedura koristimo: serološke testove za celijakiju, izdisajni test vodonika, slikovnu endoskopsku dijagnostiku i po potrebi anorektalnu manometriju.

Pojednostavljeni algoritam za početni tretman meteorizma je sažet na slici 1 [3].

Slika 1. Pojednostavljeni postupak početne obradepacijenta sa meteorizmom



Na tabeli 1 su prikazana prethodno navedena neka etiološki najčešća stanja i uobičajeni

dijagnostički postupci [3].

Tabela 1. Česta etiologija i neke od dijagnostičkih pretraga kod meteorizma

<p>“Želudačni” meteorizam</p> <p>-</p>	<ul style="list-style-type: none"> • Poremećaji pražnjenja želuca • Gastropareza • Funkcionalna dispepsija • GERB • Bilijarni gastritis 	<ul style="list-style-type: none"> • Gastroskopija • Pretrage motiliteta želuca • Sistemske bolesti- dijabetes, skleroderma...
<p>“Crevni” meteorizam</p>	<ul style="list-style-type: none"> • Intolerancija na sastojke hrane • Prekomerni rast bakterija -SIBO • Celijakija i glutenska senzitivnost • Sindrom malapsorpcije • Malignomi creva • Crevne infekcije • Ishemija creva (abdominalna angina) • Egzokrina insuficijencija pankreasa • Funkcionalne bolesti creva 	<ul style="list-style-type: none"> • Serologija za celijakiju • Izdisajni test vodonika • Slikovna i endoskopska dijagnostika • Anorektalna manometrija

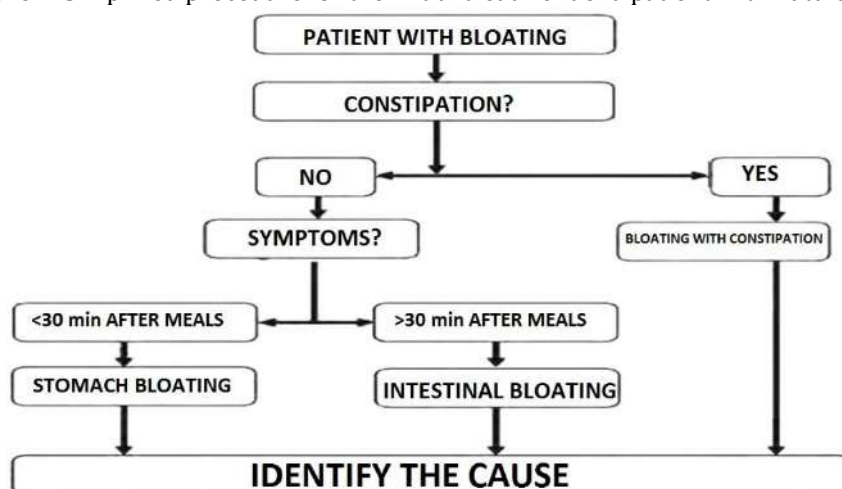
food on the gastrointestinal system. Among them, lactose intolerance is the most common [14]. If problems occur after consuming gluten in the diet, celiac disease diagnosis is necessary [15]. Exocrine pancreatic insufficiency in older individuals is not so rare [16].

Bloating can also result from certain medications, and it is one of the side effects of metformin, while opioid analgesics can cause both bloating and constipation simultaneously [11]. In the case of constipation, there is disrupted stool and gas expulsion, which then accumulate in the digestive tract. Up to 80% of patients report bloating symptoms when they have constipation. In most patients, bloating symptoms will disappear after resolving constipation [17]. When further defining the causes of bloating, the timing of the onset of symptoms can be helpful. If discomfort occurs shortly after eating, the cause of bloating is usually in the upper gastrointestinal tract - "gastric bloating." However, if a patient reports bloating long after eating, the cause is usually

lower in the digestive tract - "intestinal bloating."

In summary: When "gastric" meteorism is present, we usually think of disorders of gastric emptying, gastroparesis, functional dyspepsia, GERD, or biliary gastritis. In this case, the most commonly used diagnostic tools are gastroscopy or X-ray imaging of the upper GI tract. If it is "intestinal" meteorism, we suspect intolerance to food ingredients, small intestinal bacterial overgrowth (SIBO), celiac disease and gluten sensitivity, malabsorption syndrome, bowel malignancy, intestinal infections, bowel ischemia (abdominal angina), exocrine pancreatic insufficiency, or functional bowel diseases. Diagnostic procedures include serological tests for celiac disease, hydrogen breath test, imaging and endoscopic diagnostics, and if necessary, anorectal manometry. A simplified algorithm for the initial treatment of meteorism is summarized in Figure 1 [3].

Figure 1. Simplified procedure for the initial treatment of a patient with flatulence



Pojedina značajnija stanja koja izazivaju nadimanje

Među češćim uzrocima nadimanja su bolesti usled izmenjene apsorpcije hranljivih materija i netolerancije na ishranu. Najčešći uzroci malapsorpcije često se mogu isključiti bez invazivnih intervencija, čak i na nivou primarne zdravstvene zaštite. Poslednjih godina bolesti povezane sa glutenom postale su značajna oboljenja gastrointestinalnog trakta. O njima moramo razmišljati, između ostalog i zbog njihove epidemiološke dimenzije. Prema nekim procenama, celijakija, necelijakna osetljivost na gluten i alergija na pšenicu pogađaju čak 6% opšte populacije, a svima im je zajedničko da su simptomi posledica štetnog dejstva glutena. Uvođenjem bezglutenske dijeta kod većine pacijenata dolazi do objektivnog i subjektivnog poboljšanja bolesti [14,18].

Celijakija

Celijakija je bolest koju uvek treba uzeti u obzir kod pacijenata sa nadimanjem. Javlja se kod 1-2% populacije i najčešća je enteropatija. U svim starosnim grupama, na to moramo obratiti posebnu pažnju. Posebno o njoj moramo voditi računa u grupi pacijenata kod kojih se celijakija češće pojavljuje. Reč je o pacijentima sa dijabetesom tipa 1 i pacijentima sa Hašimotovim tireoiditisom, za koje moramo da imamo još niži prag racionalnosti kada ih upućujemo na testiranje [18,19]. Serološka dijagnostika je pouzdana, tačna i pristupačna kod celijakije, tako da igra ulogu „skrining“ testiranja. Određivanje IgA antitela protiv tkivne transglutaminaze (IgAtTG) je prvi test izbora. Osetljivost i specifičnost testa kod novodijagnostikovane celijakije je 95%. Određivanje antitela protiv glijadina (prvi korišćeni serološki test za celijakiju) je potpuno napušteno iz kliničke prakse zbog niske osetljivosti i specifičnosti. Takođe, ređe se određuju antiendomizijska antitela (EMA); korisna su samo kao dopunsko testiranje za granične vrednosti IgAtTG rezultata [20]. Uprkos visokoj specifičnosti i osetljivosti serološkog testiranja, kod odraslih pacijenata to nije dovoljno za postavljanje dijagnoze celijakije. Za konačnu dijagnozu neophodna je gastroskopija i histološki pregled biopsije duodenalne sluzokože [19]. Svi pacijenti sa pozitivnim serološkim nalazom moraju biti upućeni na endoskopsku dijagnozu. Bez obzira na rezultat serološkog ispitivanja, endoskopska dijagnoza se vrši kod pacijenata sa velikom verovatnoćom celijakije. A to je kod:

simptomatske malapsorpcija, neobjašnjive dijareje sa gubitkom težine, neobjašnjive sideropenična anemije, herpetiformnog dermatitisa, simptomatski bolesnici koji su u prvom kolenu srodstva sa bolesnicima obolelim od celijakije [19]. I serološko ispitivanje i endoskopski pregled moraju se obaviti kod pacijenata koji su na ishrani dijetom koja sadrži gluten. Ako je pacijent u vreme testiranja na dijeti bez glutena, moramo ga opteretiti glutenom. Nedavna istraživanja su pokazala da čak i male količine glutena izazivaju upalu. Pacijent mora da unese najmanje 3g glutena dnevno, što znači samo 1-2 kriške belog hleba, a ne više od 10g prema preporuci. Opterećenje glutenom mora trajati najmanje 2 nedelje, a ako pacijent toleriše ishranu takvu ishranu i do 6 nedelja [20,21]. Pre testa opterećenja glutenom, ipak preporučujemo serološko testiranje, čak i ako je pacijent na dijeti bez glutena, pošto povišeni titar antitela može da traje nekoliko nedelja nakon uvođenja dijeta bez glutena [21].

Genetsko testiranje na celijakiju ponekad se može primeniti kod pacijenata koji su već na bezglutenskoj dijeti. Koristi se za određivanje prisustva HLA DK 2 i DK8 alela, što je neophodno za razvoj celijakije; odsustvo alela za ovo isključuje bolest sa verovatnoćom većom od 99%. Inače, genetsko testiranje se ne koristi u rutinskoj praksi, jer samo 12% ima pozitivnu prediktivnu vrednost, indikovano je za nejasne oblike celijakije i za dijagnostikovanje refraktornih oblika bolesti [18,21].

Osetljivost na gluten bez celijakije (eng. »non-celiac gluten sensitivity«) tek je poslednjih godina postala posebna nozološka jedinica „nezavisna“ od funkcionalnih oboljenja gastrointestinalnog trakta i shvata se kao bolest sama za sebe. Simptomi su raznovrsni i slični simptomima celijakije i drugih funkcionalnih oboljenja gastrointestinalnog trakta. Oni su povezani sa konzumiranjem glutena. Pošto je mehanizam bolesti slabo shvaćen, još uvek nije otkriven dijagnostički biomarker. Prema tome, necelijakijska osetljivost na gluten je dijagnoza koja se postavlja „per exclusionem“-isključivanjem celijakije [15,18,22]. Celijakija se prvo mora isključiti serološkim testiranjem; po indikacijama vršimo i endoskopski pregled i histopatološki pregled biopsija duodenalne sluzokože. U drugom koraku, alergija na pšenicu se isključuje kožnim ubodom ili određivanjem specifičnih antitela [18, 22]. Alergija na pšenicu je rezultat klasične alergijske reakcije

Table 1 shows some of the previously mentioned etiologically most common conditions and common diagnostic procedures [3].

Table 1. Common etiology and some of the diagnostic tests for flatulence

"STOMACH" BLOATING	<ul style="list-style-type: none"> • Stomach emptying disorders • Gastroparesis • Functional dyspepsia • GERD (Gastroesophageal Reflux Disease) • Biliary gastritis 	<ul style="list-style-type: none"> • Gastroscopy • Gastric motility tests • Systemic diseases – diabetes, scleroderma...
"INTESTINAL" BLOATING	<ul style="list-style-type: none"> • Food ingredient intolerance • Small intestinal bacterial overgrowth (SIBO) • Celiac disease and gluten sensitivity • Malabsorption syndrome • Intestinal malignancies • Intestinal infections • Intestinal ischemia (abdominal angina) • Exocrine pancreatic insufficiency • Functional bowel diseases 	<ul style="list-style-type: none"> • Serology for celiac disease • Hydrogen breath test • Imaging and endoscopic diagnostics • Anorectal manometry

Certain more significant conditions that cause bloating

Among the more common causes of bloating are diseases due to altered absorption of nutrients and food intolerances. The most common causes of malabsorption can often be ruled out without invasive interventions, even at the primary healthcare level. In recent years, gluten-related diseases have become significant gastrointestinal tract disorders. We must consider them, among other reasons, because of their epidemiological dimensions. According to some estimates, celiac disease, non-celiac gluten sensitivity, and wheat allergy affect up to 6% of the general population, and they all share symptoms resulting from the harmful effects of gluten. Introducing a gluten-free diet for most patients leads to objective and subjective improvement of the disease [14,18].

Celiac disease

Celiac disease is a condition that should always be considered in patients with bloating. It affects 1-2% of the population and is the most common enteropathy. Special attention must be paid to it in all age groups, especially in patients with type 1 diabetes and Hashimoto's thyroiditis, where a lower threshold of suspicion for testing should be maintained [18,19]. Serological diagnostics play a role as a screening test, with the determination of IgA antibodies against tissue transglutaminase (IgAtTG) being the first-choice test. Despite the high specificity and sensitivity of serological testing, it is not sufficient for diagnosing celiac disease in adults.

Confirmation through endoscopic examination and histological examination of duodenal mucosa biopsy is necessary for a definitive diagnosis. All patients with positive serological findings should be referred for endoscopic diagnosis. Regardless of the serological test result, endoscopic diagnosis is performed in patients with a high probability of celiac disease. Patients with symptomatic malabsorption, unexplained diarrhea with weight loss, unexplained iron-deficiency anemia, herpetiform dermatitis, or symptomatic patients who are first-degree relatives of celiac disease patients fall into this category [19]. Serological testing and endoscopic examination must be performed in patients following a gluten-containing diet. If the patient is on a gluten-free diet at the time of testing, they must be gluten-loaded. Recent studies have shown that even small amounts of gluten can induce inflammation. The gluten challenge should last at least 2 weeks, and if the patient tolerates the diet, it can be extended up to 6 weeks [20,21]. Genetic testing for celiac disease may be used in patients already on a gluten-free diet to determine the presence of HLA DQ2 and DQ8 alleles, which are necessary for celiac disease development; the absence of these alleles excludes the disease with a probability of over 99%. However, genetic testing is not used in routine practice and is indicated for unclear forms of celiac disease and diagnosing refractory forms of the disease [21].

(preosetljivost tipa 1) na proteine sadržane u pšenici, uključujući gluten. Prilikom unošenja antigena u organizam, alergija može da zahvati kožu, respiratorni sistem ili sistem za varenje. Gastrointestinalni simptomi su veoma nespecifični: osećaj nadimanja, nadutost, dijareja..., ali se alergijska reakcija može manifestovati i anafilaksijom [23].

Značaj dijeta bez glutena u bolestima zavisnim od glutena - Dijeta bez glutena znači da pacijent iz ishrane eliminiše svu hranu koja sadrži pšenicu, raž, ječam i srodne žitarice. U poređenju sa normalnom ishranom, dijeta bez glutena je skuplja i teže dostupna, osim toga, pacijenti moraju da obrate veliku pažnju na „skriveno izvore glutena“, jer se gluten pojavljuje i u raznim sosovima, supama, prerađenim morskim plodovima, sušenim mesnim prerađevinama, prelivima. Takođe, lekar koji vodi pacijenta mora biti svestan da bezglutenska ishrana nije uvek izbalansirana i da pacijent može da unese nedovoljno vlakana, vitamine B kompleksa, gvožđe i elemente u tragovima (cink, bakar, selen...) [24,25]. Celijakija je hronična, doživotna bolest koja, ako se ne leči, može dovesti do mnogih ozbiljnih komplikacija (osteoporoza, razvoj drugih autoimunih bolesti, T-ćelijski limfom). Zato je stroga doživotna ishrana osnova terapije. Dijeta bez glutena kod pacijenata sa celijakijom smanjuje pojavu simptoma, poboljšava kvalitet života, poboljšava nutritivni status i sprečava komplikacije bolesti [25]. Simptomi bolesti nestaju u roku od 2-4 nedelje, serološki testovi se normalizuju za nekoliko nedelja do meseci, a sluzokoža se potpuno regeneriše nakon oko godinu dana. Merenje antitela specifičnih za celijakiju je najpogodniji test za procenu usaglašenosti pacijenta sa ishranom bez glutena. Ako se posle 6-12 meseci stroge dijeta bez glutena nivo antitela u krvnim ćelijama normalizuje, ali pacijent i dalje prijavljuje simptome bolesti, to zahteva dalje razmatranje dijetetičara i gastroenterologa. Neophodno je isključiti kontaminaciju glutenom, refraktorne oblike bolesti ili moguću prateću patologiju [18,20,22].

Dijeta bez glutena je takođe osnova lečenja osetljivosti na gluten bez celijakije. Cilj je remisija simptoma i subjektivno blagostanje pacijenta. Za sada ne postoje jasne preporuke o neophodnosti trajne bezglutenske dijeta kod tih pacijenata. Naime, premalo je istraživanja o tome da li je necelijakalnaosetljivost na gluten samo prolazno ili hronično bolesno stanje [18].

Egzokrina insuficijencija pankreasa (EIP) je čest i često zanemaren uzrok nadimanja, posebno kod starijih. Uzroci egzokrine insuficijencije pankreasa dele se na pankreasne ili primarne i nepankreasne ili sekundarne. U praksi se u dijagnostici koristi određivanje elastaze u stolici, ali se u poslednje vreme koristi sekretin MRCP (mnogo veća osetljivost i specifičnost) [3]. EIP u velikoj meri smanjuje kvalitet života, a dijagnostiku se uz pomoć kliničke slike i testova funkcije pankreasa. Lečenje uključuje prilagođavanje načina života, suplementaciju vitaminima i terapiju supstitucije enzima pankreasa. Dugoročni ciljevi su eliminisanje kliničkih simptoma i korekcija pothranjenosti i lečenje osnovne bolesti, kada je samo to prisutno. Enzimsko supstituciono lečenje ima dijagnostički i terapijski značaj i dovodi do značajnog poboljšanja simptoma i bolji kvalitet života pacijenata [26].

Tretmanmeteorizma i abdominalne distenzije izazvan funkcionalnim poremećajima posle isključivanja znakova alarma i organske bolesti, podrazumeva postepeni, individualizovani tretman. Pacijentima sa blagim funkcionalnim nadimanjem možda će biti potrebno samo uveravanje da je stanje benigno, dobro i ne najavljuje nikakvu bolest opasnu po život.

Simptomatsko lečenje - Nekoliko agenasa je dostupno za lečenje ovih poremećaja. Antispazmodici su pokazali određenu kliničku korist u ublažavanju simptoma kod nekih pacijenata [27]. Pokazano je da simetikon može smanjiti učestalost i težinu meteorizma, distenzije i nadimanja [28,29]. Ulje pepermintata je smanjilo distenziju abdomena u poređenju sa placebom [30,31]. Uprkos njihovoj popularnosti, nedostaju dokazi u vezi sa drugim često korišćenim agensima kao što su aktivni ugljen, Iberogast i soli magnezijuma.

Dijetalna intervencija - Uloga dijetetske terapije u upravljanju simptomima nadimanja je ključna i generalno se uvodi rano u plan lečenja. Glavni razlog dijetalne terapije je da se identifikuju namirnice koje pacijent ne podnosi i na taj način se smanji prekomerna fermentacija ostataka hrane. U početku se može izvršiti empirijska restrikcija laktoze i drugih slabo apsorbovanih ugljenih hidrata [12]. Alternativno, pacijentima sa sa meteorizmom i abdominalnom distenzijom može se ponuditi FODMAP dijeta ili druge eliminacione dijeta ukoliko nisu postigli poboljšanje na restriktivnoj dijeti [32].

Non-celiac gluten sensitivity (NCGS) has emerged as a separate nosological entity in recent years. Symptoms are varied and similar to those of celiac disease and other functional gastrointestinal disorders, associated with gluten consumption. Since the mechanism of the disease is poorly understood, there is still no diagnostic biomarker. Therefore, the diagnosis of non-celiac gluten sensitivity is made by excluding celiac disease. Wheat allergy, on the other hand, results from a classic allergic reaction (type 1 hypersensitivity) to proteins contained in wheat, including gluten. When antigens enter the body, the allergy can affect the skin, respiratory system, or digestive system. Gastrointestinal symptoms are nonspecific, including bloating, distension, diarrhea, but allergic reactions can also manifest as anaphylaxis. The diagnosis involves excluding celiac disease through serological testing and, if indicated, performing endoscopic examination and histopathological examination of duodenal mucosa biopsy. Allergy to wheat is confirmed through skin prick tests or by determining specific antibodies [23].

A gluten-free diet is crucial in gluten-related diseases. It involves eliminating all foods containing wheat, rye, barley, and related grains. Compared to a normal diet, a gluten-free diet is more expensive and less accessible. Patients must also pay close attention to hidden sources of gluten, as it appears in various sauces, soups, processed seafood, dried meat products, and dressings. Additionally, the managing physician must be aware that a gluten-free diet is not always balanced, and the patient may consume insufficient fiber, B-complex vitamins, iron, and trace elements (zinc, copper, selenium...) [24,25]. Celiac disease is a chronic, lifelong condition that, if left untreated, can lead to many serious complications (osteoporosis, the development of other autoimmune diseases, T-cell lymphoma). Therefore, strict lifelong dietary adherence is the cornerstone of therapy. A gluten-free diet in patients with celiac disease reduces symptom occurrence, improves quality of life, enhances nutritional status, and prevents disease complications. Symptoms disappear within 2-4 weeks, serological tests normalize within weeks to months, and the mucosa completely regenerates after about a year. Measurement of antibodies specific to celiac disease is the most suitable test for assessing patient compliance with a gluten-free diet. If

after 6-12 months of strict gluten-free diet, antibody levels in blood cells normalize but the patient still reports symptoms, further evaluation by a dietitian and gastroenterologist is required. It is necessary to exclude gluten contamination, refractory forms of the disease, or possible accompanying pathology [18,20,22].

A gluten-free diet is also the foundation of treatment for non-celiac gluten sensitivity. The goal is symptom remission and subjective well-being of the patient. Currently, there are no clear recommendations regarding the necessity of a lifelong gluten-free diet in these patients. There is insufficient research on whether non-celiac gluten sensitivity is only transient or a chronic disease state [18].

Pancreatic exocrine insufficiency (PEI) is a common and often overlooked cause of bloating, especially in older individuals. The causes of pancreatic exocrine insufficiency are divided into pancreatic or primary and non-pancreatic or secondary. In practice, elastase determination in stool is used in diagnostics, but lately, secretin MRCP (with much higher sensitivity and specificity) has been employed. PEI significantly reduces the quality of life and is diagnosed through clinical presentation and pancreatic function tests. Treatment involves lifestyle adjustments, vitamin supplementation, and pancreatic enzyme replacement therapy. Long-term goals include eliminating clinical symptoms and correcting malnutrition, addressing only the underlying disease when present. Enzyme replacement therapy has both diagnostic and therapeutic significance and leads to significant symptom improvement and better quality of life for patients [26].

The treatment of meteorism and abdominal distension caused by functional disorders, after excluding alarm signs and organic diseases, involves gradual, individualized treatment. Patients with mild functional bloating may only require reassurance that the condition is benign, well, and not indicative of any life-threatening disease.

Symptomatic treatment - Several agents are available for treating these disorders. Antispasmodics have shown some clinical benefit in alleviating symptoms in some patients [27]. Simethicone has been shown to reduce the frequency and severity of meteorism, distension, and bloating [28,29]. Peppermint oil reduced abdominal distension compared to placebo

Rešavanje zatvora - Pacijenti sa hroničnom idiopatskom konstipacijom (CIC) i iritabilnim crevnim sindromom sa opstipacijom (IBS-tip C) obično u anamnezi prijavljuju nadimanje. Utvrđeno je da lubiproston, smanjuje nadimanje u dve placebo kontrolisane kliničke studije koje su uključivale pacijente sa IBS-tip C [16,34]. Utvrđeno je da prokinetik prukaloprid, selektivni agonist 5-HT4 receptora, pojačava spontano pražnjenje creva i smanjuje nadimanje [35]. Slično, utvrđeno je da linaklotid, agonist gvanilat ciklaze C, poboljšava simptome zatvora (pospešeno spontano pražnjenje creva) i smanjuje bol u trbuhu i nadimanje kod pacijenata sa CIC i IBS-C [36-42]

Modulacija mikrobite - Smanjenje bakterija koje proizvode gas ili izazivanje promena u njihovim metaboličkim aktivnostima može smanjiti prekomernu fermentaciju i nadimanje. Utvrđeno je da rifaksim, slabo apsorbovan antibiotik širokog spektra, smanjuje osećaj nadimanja i nadutost u kontrolisanim ispitivanjima kod pacijenata sa i bez IBS [45,46]. Probiotici mogu postati terapijska opcija u FABD; međutim, studije su otkrile različite rezultate, verovatno zbog nedostatka standardizovanih metoda proučavanja [47,48]. U nedavnom pregledu sugerisano je da probiotici imaju ulogu u lečenju funkcionalnih gastrointestinalnih poremećaja [49]. U dvostruko slepoj studiji Ringela et al. pokazalo se da *Lactobacillus acidophilus* i *Bifidobacterium lactis* Bi-07 smanjuju nadimanje kod pacijenata sa funkcionalnim gastrointestinalnim poremećajima bez konstipacije [50].

Abdominalna biofeedback terapija - Kao što je opisano, meteorizam i abdominalna distenzija nakon obroka može biti rezultat abnormalnog opuštanja prednjeg trbušnog zida i kontrakcije dijafragme. Pokazano je da je moguće edukovati pacijente kako da koriste svoje trbušne i dijafragmatične mišiće da bi se smanjile tegobe u vezi sa meteorizmom i distenzijom trbuha [51].

Modulacija osovine mozak-crevo Ako su pojačana percepcija istezanja zida creva i

visceralna preosetljivost ključne komponente u patogenezi funkcionalnih gastrontestinalnih poremećaja sa meteorizmom i abdominalnom distenzijom, onda se čini da je modulacija osovine mozak-crevo razumna opcija lečenja. Procenjena je učinkovitost antidepresiva, kao što su triciklični antidepresiv (TCA) i selektivni inhibitori preuzimanja serotonina (SSRI) kod pacijenata sa IBS. U maloj, kontrolisanoj unakrsnoj studiji, citalopram (SSRI) je pokazao povećanje broja dana bez nadimanja nakon 3 i 6 nedelja [53]. U drugoj studiji, desipramin u kombinaciji sa kognitivno bihevioralnom terapijom smanjio je nadimanje [54]. Hipnoterapija i kognitivna bihevioralna terapija, koje se takođe nude pacijentima sa IBS, mogu biti efikasne kod pacijenata sa funkcionalnim gastrontestinalnim poremećajima [55].

ZAKLJUČAK

Meteorizam i abdominalna distenzija predstavljaju čest klinički problem. Kao i za bilo koje drugo zdravstveno stanje, klinička procena gastrointestinalnih poremećaja sa meteorizmom i abdominalnom distenzijom počinje detaljnom anamnezom, fizikalnim pregledom i odgovarajućim dijagnostičkim testovima. Ključno je isključiti bilo koji organski uzrok nadimanja i distenzije. Posebno ne treba zanemariti alarmne simptome koji mogu ukazivati na ozbiljniju patologiju. U zavisnosti od učestalosti, uvek moramo misliti na bolesti povezane sa glutenom, a kod starijih i na egzokrinu insuficijenciju pankreasa. Serološkim ispitivanjem celijakija se može u dovoljnoj meri isključiti već na nivou primarne ili sekundarne medicinske ustanove. U lečenju je poželjan postepeni, multidisciplinarni, individualizovani pristup. Terapija može biti usmerena na pokretljivost creva, mišićni tonus, mikrobiotu, visceralnu osetljivost, ishranu i/ili psihološki komorbiditet. Takođe, "ex iuvantibus" odgovor bolesti na lečenje -poboljšanje simptoma uz terapiju supstitucije enzima pankreasa ukazuje na egzokrinu insuficijenciju pankreasa.

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[30,31]. Despite their popularity, evidence is lacking regarding other commonly used agents such as activated charcoal, Iberogast, and magnesium salts.

Dietary intervention - The role of dietary therapy in managing bloating symptoms is crucial and is generally introduced early in the treatment plan. The main reason for dietary therapy is to identify foods that the patient does not tolerate and thus reduce excessive fermentation of food residues. Initially, empirical lactose and other poorly absorbed carbohydrate restrictions may be implemented [12]. Alternatively, FODMAP diet or other elimination diets may be offered to patients with meteorism and abdominal distension if they have not improved on a restrictive diet [32].

Addressing constipation - Patients with chronic idiopathic constipation (CIC) and irritable bowel syndrome with constipation (IBS-C) usually report bloating in their medical history. Lubiprostone has been found to reduce bloating in two placebo-controlled clinical trials involving patients with IBS-C [16,34]. Prucalopride, a selective 5-HT₄ receptor agonist, enhances spontaneous bowel movements and reduces bloating [35]. Similarly, linaclotide, a guanylate cyclase C agonist, improves constipation symptoms and reduces abdominal pain and bloating in patients with CIC and IBS-C [36-42].

Microbiota modulation - Reducing gas-producing bacteria or inducing changes in their metabolic activities may reduce excessive fermentation and bloating. Rifaximin, a poorly absorbed broad-spectrum antibiotic, has been found to reduce bloating and flatulence in controlled trials in patients with and without IBS [45,46]. Probiotics may become a therapeutic option in FABD; however, studies have yielded different results, likely due to the lack of standardized study methods [47,48]. A recent review suggested that probiotics have a role in the treatment of functional gastrointestinal disorders [49]. In a double-blind study, Ringel et al. found that *Lactobacillus acidophilus* and *Bifidobacterium lactis* Bi-07 reduced bloating in patients with functional gastrointestinal disorders without constipation [50].

Abdominal biofeedback therapy - As described, postprandial meteorism and abdominal distension may result from abnormal relaxation of the anterior abdominal wall and diaphragmatic contraction. It has been shown

that patients can be educated to use their abdominal and diaphragmatic muscles to reduce discomfort associated with meteorism and abdominal distension [51].

Modulation of the brain-gut axis - If heightened perception of bowel wall stretching and visceral hypersensitivity are key components in the pathogenesis of functional gastrointestinal disorders with meteorism and abdominal distension, then modulation of the brain-gut axis appears to be a reasonable treatment option. The efficacy of antidepressants, such as tricyclic antidepressants (TCA) and selective serotonin reuptake inhibitors (SSRI), has been evaluated in patients with IBS. In a small, controlled crossover study, citalopram (SSRI) showed an increase in the number of days without bloating after 3 and 6 weeks. In another study, desipramine in combination with cognitive-behavioral therapy reduced bloating. Hypnotherapy and cognitive-behavioral therapy, also offered to patients with IBS, may be effective in patients with functional gastrointestinal disorders [55].

CONCLUSION

Meteorism and abdominal distension represent a common clinical problem. Like any other health condition, the clinical assessment of gastrointestinal disorders with meteorism and abdominal distension begins with a detailed medical history, physical examination, and appropriate diagnostic tests. It is crucial to exclude any organic cause of bloating and distension. Alarm symptoms, which may indicate more serious pathology, should not be overlooked. Depending on the frequency, gluten-related diseases should always be considered, and in the elderly, pancreatic exocrine insufficiency should also be considered. Celiac disease can be sufficiently excluded with serological testing, even at the level of primary or secondary medical facilities. In treatment, a gradual, multidisciplinary, individualized approach is desirable. Therapy may target bowel motility, muscle tone, microbiota, visceral sensitivity, nutrition, and/or psychological comorbidities. Additionally, an "ex juvantibus" response to treatment – improvement of symptoms with pancreatic enzyme replacement therapy – indicates pancreatic exocrine insufficiency.

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