

# ACUTE INTESTINAL OBSTRUCTION OF NONNEOPLASTIC ORIGIN: CURRENT STATE OF THE PROBLEM

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Recent Russian and foreign publications on the problem of surgical management of acute intestinal obstruction of nonneoplastic origin were reviewed. Current views on the main pathogenetic aspects determining the severity of the disease and the high incidence of lethal complications were represented. The features of the pathology in elderly patients were shown. There was proved the necessity of a comprehensive examination of patients enabling to determine not only the obstruction nature, but also the degree of functional impairments of vital organs and systems due to the comorbidity; and emphasized the complexity of intraoperative assessment of the viability of the bowel area with impaired blood supply making surgeons to expand the volume of bowel resection. The features of the decompression nasogastrintestinal intubation of the digestive tract and its sanitation through a probe were represented. The feasibility of a multidisciplinary approach in preoperative preparation planning and choosing an anesthetic technique and treatment of patients after the surgery was demonstrated.

**Key words:** acute intestinal obstruction; intestinal insufficiency syndrome; intraabdominal hypertension; nasogastrintestinal intubation.

Acute intestinal obstruction of nonneoplastic origin (AIONNO) has been remaining for many years one of the hot problems of the abdominal emergency surgery. Despite the adoption of modern diagnostic techniques and surgical interventions, the results of treatment of such kinds of patients do not satisfy clinicians. Post-operative mortality reaches 12–20% according to different authors [1–5]. The most unfavorable outcomes of AIONNO surgical treatment are observed in elderly patients (over 60 years) [6–10].

The main pathogenetic cause, leading to the development of polyorganic insufficiency and death of the elderly patients in the early post-operative period, is bowel insufficiency syndrome (BIS) with a heavy accompanying pathology which is present in patients over 60 years of age with AIONNO [9–12]. BIS occurrence is due to the changes of the secretion, absorption and barrier function of the bowel. Two phases are distinguished in the course of BIS. The first is the phase of endotoxin aggression. It is characterized by translocation of toxins and microorganisms into the abdominal cavity and systemic circulation, which is accompanied by a marked intoxication (up to a toxic shock), resulting in severe functional disorders of vital organs [13–15]. The second is the phase of progressing endotoxemia. In this phase further elevation of endotoxin concentration in the blood and in the content of the large intestine takes place, dysbiosis develops, the disturbance of the liver function with the depression of its reticuloendothelial system occurs, portal and mesenteric hemodynamics is affected, which contributes to the formation of endothelial dysfunction and lipid distress syndrome [16–17].

The second pathogenetic factor, determining the severity

of the condition of patients with AIONNO, is considered to be abdominal compartment syndrome [12, 18–20, 21]. The increase of intra-abdominal pressure in the early postsurgical period is observed in 30% of patients with AIONNO. The excessive pressure in the abdominal cavity results in the dislocation of the diaphragm and compression of the lung parenchyma, venous congestion and higher risk of thromboembolic complications, as well as liver insufficiency [12, 19–21].

The above-mentioned pathological processes are especially heavy in elderly patients with AIONNO, having a number of concurrent diseases accompanied by cardiovascular, respiratory and metabolic disturbances.

Changes in the structure of etiological factors is an important feature of AIONNO nowadays. Node formation, volvulus, invagination occur much rarer [23–25]. At the same time, the incidence of adhesion obstruction increased. It is this type of obstruction that causes the bulk of postoperative complications and fatal outcomes [7, 26]. A quick progressing of the intestinal wall ischemia, caused by the vessel compression of its mesentery, leads to the development of irreversible changes demanding extension of the operation volume [27]. Hemodynamic disorders are especially severe in elderly people [8]. Concurrent somatic pathology (atherosclerosis, hypertension, diabetes mellitus) in this cohort of patients contributes to the irreversible sequela of bowel ischemia [8, 28, 29].

High mortality rate in AIONNO is also determined by the fact that in 30–40% of patients the operation is performed a day later the onset of the disease [30]. It is so not only because patients do not seek medical aid in time, but also

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by the delayed selection of the adequate management tactics [28, 30–32]. Until now there are no definite criteria, which allow surgeons to use the correct type of treatment: conservative or urgent surgery [3, 16, 33, 34].

The principle question, defining the surgical tactics in connection with patients with AIONNO, is to find the causes of obstruction. B.T. Fevang et al. consider all variants of strangulation BIS (incarceration, volvulus, node forming) to be absolute indications for emergency intervention after a short preoperative preparation [33]. However, if symptoms of obstruction occur when a patient has suffered from a prolonged adhesive disease, especially in patients operated previously several times on this condition, as well as in patients with a heavy concurrent pathology, tactics of actively wait-and-see is quite justified [7, 33, 34]. It includes a number of conservative procedures to eliminate the obstruction (continuous decompression of the upper parts of the digestive tract through a nasogastric probe, intensive infusion therapy with introduction of spasmolytic preparations, enemas), in combination with diagnostic actions to make a final diagnosis [4, 35, 36].

Many authors in Russia and abroad, solving the tactical questions of managing patients with AIONNO, especially aged people, point the necessity of formulating a clear program of diagnostic procedures, oriented not only towards making a basic diagnosis, but towards revealing the character and degree of function impairment of vital organs and systems [8, 9, 14, 30, 31, 37]. A detailed analysis of the main and additional complaints of the patient, the history of disease development, objective clinical symptoms enables the surgeon to suggest a diagnosis and to outline an optimal amount of laboratory, functional and instrumental methods of investigation [2, 37].

X-ray examination remains a routine and the most commonly used method of diagnosing AIONNO in the emergency surgery up till now. Unfortunately, such classical signs of obstruction as “Kloiber’s cup” (a dome-like accumulation of gas over the liquid level) and arches with transverse lines, are visualized mainly at the late stages of the disease development. Using contrast water solution of barium sulfate makes it sometimes possible to define the level of obstruction, but this procedure takes much time, and is not justified in case of strangulation nature of the disease [26, 38].

But even if there are no characteristic radiological signs, the diagnosis of AIONNO cannot be excluded completely, especially in case of a “high” localization of obstruction [28, 38].

Currently, ultrasound diagnosis is successfully used for early revealing of AIONNO, detecting the signs of the “isolated” bowel loop, pendulum-like peristalsis of the expanded bowel area and a narrow liquid strip around the expanded loop, which increases quickly when the pathological process progresses [23, 39].

Foreign literature of the last years began to publish the reports, devoted to the diagnostic feasibilities of magneto-resonance tomography in patients with suspected AIONNO, but in Russia this technique has not received much attention as yet [40]

In diagnosing AIONNO, especially its mild forms,

monitoring of intra-abdominal pressure (IAP) may be of a significant help. This investigation is carried on by an indirect way, measuring the pressure in the bladder in the course of preparation for the operation or conservative procedures. If IAP values exceed  $25.6 \pm 6.8$  cm H<sub>2</sub>O, it is recommended to use active surgical tactics, while conservative therapy is preferred when these values are  $12.8 \pm 3.3$  cm H<sub>2</sub>O or less [41].

The authors [42–44], possessing sufficient clinical experience in endovideosurgical interventions (laparoscopy), are convinced, that this technique allows clinicians to find out timely the cause of obstruction and, in some cases, to eliminate it. Contraindications to laparoscopy are peritonitis, massive adhesion process or marked paresis of the bowel.

Making a diagnostic exploration in elderly people, special attention should be given not only to clarifying the character and level of obstruction, but to the examination of the functional state of the respiratory and cardio-vascular systems as well. The data obtained may be of crucial significance in planning treatment tactics in this cohort [8, 45].

A number of authors agrees that a variety and complexity of pathogenic factors of AIONNO together with the accompanying pathology in elderly people dictate the necessity of formulating multidisciplinary concept, which would imply participation of a team of specialists (a surgeon, therapist, sometimes, a cardiologist and pulmonologist, a specialist in functional diagnostics, and anesthesiologist-resuscitator as well) in the treatment process. Such approach can help to outline an adequate volume of preoperative preparation, drug therapy, to determine the type of anesthesia, and to plan specific individual approaches to the patient’s management in the post-operative period, taking into account metabolic and somatic disorders [8, 9, 31, 45, 46].

The majority of Russian and foreign surgeons agrees unanimously that the most rational access, permitting to find and eliminate the cause of AIONNO is median laparotomy [1, 3, 4, 6, 7, 11, 31, 46]. Some authors [7, 26] draw attention to the necessity of thorough adhesiolysis — dissection of the available fusions between the intestinal loops and other organs of the abdominal cavity. This manipulation requires deliberation and concentration from the surgeon. Damage to the overdistended bowel wall may result in fatal outcome [31].

A great amount of current publications is still devoted to such an important question as the assessment of vitality of the gut area with blood supply disturbance, and if there are some necrotic changes of the intestine wall — to determination of the bowel resection volume [11, 28, 47–50]. Interpretation of visual signs (color, bowel wall edema, subserous hemorrhages, peristalsis, pulsation and blood volume of parietal vessels), together with the dynamics of these signs after introduction into the mesentery a warm solution of local anesthetic — is rather subjective. Methods offered in the recent years for assessing the degree of the bowel wall ischemia (angiotensometry, transillumination, laser Doppler flowmetry, and Dopplerography) are not always available in the common clinical practice [47–49]. Such situation defines the surgeon’s tactics: the slightest

doubts in the vitality of the intestine lead to its resection. It is recommended to remove not only the necrotized fragment, but not less than 30–40 cm of macroscopically unchanged part of the gut in the proximal direction and 15–20 cm in the distal one from the area of necrosis [11, 28]. Some authors [50] suggest the terms from the onset of the disease to be the proper guide when the resection volume is to be chosen [50]. But the resection of 50 cm of the ileum leads to the deficiency of vitamin B12, and the removal of more than 100 cm results in malabsorption and steatorrhea [3, 27, 51].

According to some opinions, the moment of elimination of acute intestinal obstruction is a starting point from which the reverse development of the pathological changes in the intestine must begin. However, investigations made by V.G. Chupris et al. [52] and A. Akcakaya et al. [53] have proved, that after strangulation removal acute reperfusion damage of the intestine wall develops. This process runs in several stages with qualitatively different levels of intraparietal intestinal microcirculation disturbances [29].

Once the cause of AIONNO is eliminated in the course of operative intervention, a special role is given to the procedures that help recover functional state of the digestive tract [5, 28]. They are decompression nasogastrintestinal intubation of the bowel and its sanitation through a probe [13–15, 54]. To pass the probe during the operation, when there are massive adhesions in the abdominal cavity, is a difficult task. Various probe modifications (one- or double-lumen), as well as different designs of the guiding olive or guiding strings are available to reduce tissue traumas and manipulation time [55–57]. Nevertheless, questions of intubation duration and possibility of using different solutions for bowel lumen sanitation are not well studied [13, 58, 59]. A.B. Bogdanovich et al. recommend using proteolysis inhibitors to arrest endotoxemia and to fight off pathogenic microbe flora in the small bowel lumen, while A.A. Babayev et al. [60] carry on bowel sanitation with ozonized solutions.

Some authors [7, 15, 61] emphasize the necessity of preventing adhesion formation recurrence in the abdominal cavity after the operation, especially if it was performed on adhesive AIONNO. For this purpose they suggest using anti-adhesive barriers, including self-resolving membranes (Seprafilm) and liquid media (Intergel) [62].

No doubt, that timely performed surgical intervention in case of AIONNO plays a decisive role in the treatment of patients with this pathology. At the same time, complex therapy in the post-operative period in order to arrest all pathogenic aspects of the disease is of great importance [37, 45, 63, 64]. It should be directed, first of all, to elimination of ischemic and reperfusion injuries of the small bowel and liver. In addition to infusions of crystalloid solutions it is reasonable to use medications improving microcirculation (Reambirin, Cytoflavinum, Trental) as well as protease inhibitors and hepatoprotectors [32, 45, 46]. B.R. Gelfand et al. [65] recommend administration of antisecretory preparations to prevent formation of acute gastro-intestinal ulcers, others [27, 46] believe that the choice of antibacterial therapy depends on the current concepts of abdominal sepsis, i.e. it must take into account the character of

pathogenic microbe flora and its sensitivity to antibiotics. Treatment should start with medications of a wide spectrum of action (aminoglycosides of the II–III generation or cephalosporins of the III generation in combination with metronidazole, or fluoroquinolones of the II generation and metronidazole). To prevent thromboembolic complications and microcirculation disturbances administration of low-molecular heparins is obligatory [6, 12, 21]. Along with intensive detoxication therapy and enterosorption it is useful to give hepatoprotectors, endothelioprotectors and metabolic probiotics to stop endotoxemia [17].

**Conclusion.** The problem of acute intestinal obstruction of nonneoplastic origin, especially in elderly patients, remains a hot topic. Clinical and diagnostic criteria, permitting to use unmistakably either conservative treatment or emergency surgery, are not so far defined. Questions of choosing adequate volume of bowel resection in case of its vitality impairment, as well as indications for and duration of intubation decompression of the digestive tract are studied insufficiently. It is useful to work out a concept of multidisciplinary approach for planning and conducting diagnostic and therapeutic measures in this category of patients. All this determines the necessity and main directions of further scientific search.

## References

1. Dederer Yu.M. *Patogenez i lechenie ostroy neprokhodimosti kishechnika* [Pathogenesis and treatment of acute intestinal obstruction]. Moscow: Meditsina; 1971; 272 p.
2. Mayorov M.I. *Klinicheskie aspekty ostroy kishechnoy neprokhodimosti*. Avtoref. dis. ... dokt. med. nauk [Clinical aspects of acute intestinal obstruction. Dissertation for the degree of Doctor of medical science]. Moscow; 2003.
3. Chupris V.G. *Ostraya tonkokishechnaya neprokhodimost' neopukhlevogo geneza (patogenez, diagnostika, lechenie) (kliniko-eksperimental'noe issledovanie)*. Avtoref. dis. ... kand. med. nauk [Acute small bowel obstruction of nonneoplastic origin (pathogenesis, diagnostics, treatment) (clinical and experimental study). Dissertation for the degree of Candidate of medical science]. Saint Petersburg; 2009.
4. Bass K.N., Jones B., Bulkley G.B. Current management of small-bowel obstruction. *Adv Surg* 1997; 31: 1–34.
5. Miyauchi T., Kuroda T., Nisioka M., Hashimoto T., et al. Clinical study of strangulation obstruction of the small bowel. *J Med Invest* 2001; 48(2): 66–72.
6. Kurygin A.A., Stoyko Yu.M., Bognenko S.F. *Neotlozhnaya khirurgicheskaya gastroenterologiya* [Emergency surgical gastroenterology]. Saint Petersburg: Piter; 2001; 469 p.
7. Plechev V.V. *Ostraya spaechnaya kishechnaya neprokhodimost' (problemy, resheniya)* [Acute adhesive intestinal obstruction (problems and solutions)]. Ufa; 2004; 279 p.
8. Kùlah B., Gülgez B., Özmen M.M., et al. Emergency bowel surgery in the elderly. *Turkish J Gastroenter* 2003; 14(3): 189–193.
9. Arenal J.J., Bengoechea-Beeby M. Mortality associated with emergency abdominal surgery in the elderly. *Can J Surg* 2003; 46: 111–116.
10. Gurleyik E. Small bowel volvulus: a common cause of mechanical intestinal obstruction in our region. *Eur J Surg* 2003; 1: 51–55.
11. *Rukovodstvo po neotlozhnoy khirurgii organov bryushnoy polosti* [Guidelines for emergency abdominal surgery]. Pod red. Savel'eva V.S. [Savel'ev V.S. (editor)]. Moscow: Triada-Kh; 2004; 640 p.
12. Dibirov M.D., Rodionov I.E., Kakubava M.R., Yuanov A.A., et al. Korrektsiya vnutribryushnoy gipertenzii i mikrotsirkulyatsii

u bol'nykh ostroy kishechnoy neprokhodimost'yu starcheskogo vozrasta [Correction of intraabdominal hypertension and microcirculation in patients with acute intestinal obstruction in the elderly]. *Moskovskiy khirurgicheskiy zhurnal — Moscow Surgical Journal* 2012; 3(25): 9–14.

13. Guzeev A.I. Intubatsiya tonkoy kishki v neotlozhnoy abdominal'noy khirurgii [Small bowel intubation in emergency abdominal surgery]. *Vestn Hir Im II Grekova — Surgery Reporter named after I.I. Grekov* 2002; 161(2): 92–95.

14. Totikov V.Z., Kalitsova M.V., Amrillaeva V.M. Lechebno-diagnosticheskaya programma pri ostroy spaechnoy obturatsionnoy tonkokishechnoy neprokhodimosti [Diagnostic and treatment program in acute adhesive small bowel obstruction]. *Khirurgiya — Surgery* 2006; 2: 38–43.

15. Kalff J.C. Surgical manipulation of the gut elicits an intestinal muscularis inflammatory response resulting in postsurgical ileus. *Ann Surg* 2007; 1: 228–232.

16. Rybachkov V.V., Mayorov M.I., Makanov O.A. Neyrogomoral'nye izmeneniya pri ostroy kishechnoy neprokhodimosti [Neurohumoral changes in acute intestinal obstruction]. *Vestn Hir Im II Grekova — Surgery Reporter named after I.I. Grekov* 2005; 164(1): 25–28.

17. Savel'ev V.S., Petukhov V.A., Karalkin A.V., et al. Sindrom kishechnoy nedostatochnosti v urgentnoy abdominal'noy khirurgii: novye metodicheskie podkhody k lecheniyu [Intestinal insufficiency syndrome in urgent abdominal surgery: new methodological approaches to treatment]. *Trudnyy patsient — A Difficult Case* 2005; 4.

18. Gel'fand B.R., Protsenko D.N., Podachin P.V., et al. Sindrom abdominal'noy gipertenzii: sostoyanie problemy [Abdominal hypertension syndrome: the state of the problem]. *Meditsinskiy al'favit. Neotlozhnaya meditsina — Medical Alphabet. Emergency Medicine* 2010; 3: 34–42.

19. Lukoyanychev E.E. *Khirurgicheskaya korrektsiya intraabdominal'noy gipertenzii pri ostroy kishechnoy neprokhodimosti (eksperimental'no-klinicheskoe issledovanie)*. Avtoref. dis. ... kand. med. nauk [Surgical correction of intraabdominal hypertension in acute intestinal obstruction (experimental and clinical study). Dissertation for the degree of Candidate of medical science]. Nizhny Novgorod; 2011.

20. Brush K.A. Abdominal compartment syndrome: the pressure is on. *Nursing* 2007; 31: 37–40.

21. Vidal M.G., Ruiz Weissner J., Gonzalez F., et al. Incidence and clinical effects of intra-abdominal hypertension in critically ill patients. *Crit Care Med* 2008; 36: 1823.

22. Petukhov V.A., Son D.A., Mironov A.V. Endotoksinovaya agressiya i disfunktsiya endoteliya pri sindrome kishechnoy nedostatochnosti v ekstrennoy khirurgii bryushnoy polosti: prichinno-sledstvennyye vzaimosvyazi [Endotoxin invasion and endothelial dysfunction in intestinal insufficiency syndrome in emergency abdominal surgery: cause-effect relationship]. *Annaly khirurgii — Surgery Annals* 2006; 5: 27–33.

23. Rakhmatullin Yu.Ya. Rezul'taty lecheniya ostroy kishechnoy neprokhodimosti [Results of treatment of acute intestinal obstruction]. *Vestnik KazNMU — Vestnik of KazNMU* 2012; 1: 281–283.

24. Kahi C.J., Rex D.K. Bowel obstruction and pseudoobstruction. *Gastroenterol Clin North Am* 2003; 32: 1229–1247.

25. Miller G., Boman J., Shrier I., Gordon P.H. Etiology of small bowel obstruction. *Am J Surg* 2000; 180(7): 33–36.

26. Gavrilik B.L. Spaechnaya kishechnaya neprokhodimost'. V kn.: *Aktual'nye voprosy neotlozhnoy khirurgii: neprokhodimost' kishechnika: sbornik nauchnykh trudov* [Adhesive intestinal obstruction. In: Relevant problems of urgent surgery: bowel obstruction: collection of scientific papers]. Otv. red. Smotrin S.M. [Smotrin S.M. (editor)]. Grodno: 2012. P. 10–14.

27. Grigor'ev P.Ya., Yakovenko A.V. *Klinicheskaya gastroenterologiya* [Clinical gastroenterology]. Moscow: Meditsinskoe informatsionnoe agentstvo; 2001; 704 p.

28. Eryukhin I.A., Petrov V.P., Khanevich M.D. *Kishechnaya neprokhodimost'* [Bowel obstruction]. Saint Petersburg: Piter; 1999; 448 p.

29. Milyukov V.E. Izmeneniya gemomikrotsirkulyatornogo

rusla pri raznykh vidakh kishechnoy neprokhodimosti [Changes in hemomicrocirculatory bloodstream in different types of bowel obstruction]. *Morfologiya — Morphology* 2001; 120(5): 31–34.

30. Korymasov E.A., Gorbunov Yu.V. Printsipy differentsial'noy diagnostiki i taktiki pri ostroy kishechnoy neprokhodimosti [Principles of differential diagnosis and management in acute intestinal obstruction]. *Khirurgiya — Surgery* 2003; 3: 101–106.

31. Ignat'ev V.V. *Algoritm khirurgicheskogo lecheniya bol'nykh s ostroy kishechnoy neprokhodimost'yu*. Avtoref. dis. ... kand. med. nauk [Algorithm of surgical management of patients with acute intestinal obstruction. Dissertation for the degree of Candidate of medical science]. Yakutsk; 2005.

32. Bogdanovich A.V., Shilenok V.N., Kirpichenok L.N. Ispol'zovanie ingibitorov proteoliza v lechenii bol'nykh ostroy spaechnoy kishechnoy neprokhodimost'yu [The use of proteolysis inhibitors in treatment of patients with acute adhesive intestinal obstruction]. *Vesti Natsional'noy akademii nauk Belarusi — News of Belarusian National Academy of Sciences* 2008; 1: 119–123.

33. Fevang B.T., Jensen D., Svanes K., et al. Early operation or conservative management of patients with small bowel obstruction? *Eur J Surg* 2002; 168: 475–481.

34. Williams S.B., Greenspon J., Young H.A., et al. Small bowel obstruction: conservative vs. surgical management. *Dis Colon Rectum* 2005; 48(6): 1140–1146.

35. Korymasov E.A., Gorbunov Yu.V. Kogda pokazana operatsiya pri spaechnoy kishechnoy neprokhodimosti [When surgery is indicated for in adhesive intestinal obstruction]. *Skoraya meditsinskaya pomoshch' — Emergency Medical Service* 2004; 5(3): 91–92.

36. Chen S.C., Yen Z.S., Lee C.C., et al. Nonsurgical management of partial adhesive small-bowel obstruction with oral therapy: a randomized controlled trial. *CMAJ* 2005; 173(10): 1165–1169.

37. Senlin P. Small Intestine obstruction. Physiopathology, etiology, diagnosis, treatment. *Rev Prat* 2005; 17: 1927–1932.

38. Biondo S., Pares D., Mora L., et al. Randomized clinical study of Gastrografin administration in patients with adhesive small bowel obstruction. *Br J Surg* 2003; 90: 542–546.

39. Jang T.B., Schindler D., Kaji A.H. Bedside ultrasonography for the detection of small bowel obstruction in the emergency department. *Emerg Med J* 2011 Aug; 28(8): 676–678.

40. Wiarda B.M., Horsthuis K., Dobben A.C., et al. Magnetic resonance imaging of the small bowel with the true FISP sequence: intra- and interobserver agreement of enteroclysis and imaging without contrast material. *Clin Imaging* 2009; 33(4): 267–273.

41. Sheyanov S.D., Kharitonova E.A., Zukhraeva Z.I. Diagnostika ostroy spaechnoy kishechnoy neprokhodimosti metodom izmereniya vnutribryushnogo davleniya [Diagnostics of acute adhesive intestinal obstruction by intraabdominal pressure measurement]. *Vestn Hir Im II Grekova — Surgery Reporter named after I.I. Grekov* 2012; 171(5): 24–30.

42. Sobolev V.E. Laparoskopiya pri ostroy neprokhodimosti kishechnika [Laparoscopy in acute intestinal obstruction]. *Endosc Hir — Endoscopic Surgery* 2007; 2: 18–20.

43. Franklin M.E., Jr. Gonzalez J.J., Miter D.B., et al. Laparoscopic diagnosis and treatment of intestinal obstruction. *Surg Endosc* 2004; 18: 26–30.

44. Bailey I.S. Laparoscopic management of acute small bowel obstruction. *Br J Surg* 2008; 1: 84–87.

45. Hendrickson M., Naparst T.R. Abdominal surgical emergencies in the elderly. *Emerg Med Clin North Am* 2003; 21: 937–969.

46. Hayanga A.J., Bass-Wilkins K., Bulkley G.B. Current management of small-bowel obstruction. *Adv Surg* 2005; 39: 1–33.

47. Khryachkov V.V., Sazanov V.V. *Novye sposoby opredeleniya zhiznesposobnosti diskreditirovannykh uchastkov kishki v khirurgii* [New methods for determination of viability of discredited bowel areas in surgery]. Khanty-Mansiysk: Poligrafist; 2000; 40 p.

48. Leont'ev S.N., Sovtsov S.A., Podshivalov V.Yu. Diagnosticheskaya tsennost' dopplerografii pri mekhanicheskoy kishechnoy neprokhodimosti [Doppler sonography diagnostic value in mechanical intestinal obstruction]. *Vestn Hir Im II Grekova — Surgery Reporter named after I.I. Grekov* 2002; 26: 37–39.

49. Dadzhiev A.B. *Sostoyanie mikrotsirkulyatsii v stenke kishki*

pri obturatsionnoy kishechnoy neprokhodimosti i ee vliyanie na vybor ob'ema i kharaktera operatsii. Avtoref. dis. ... kand. med. nauk [Microcirculatory condition in bowel wall in obturation intestinal obstruction and its effect on the choice of the operation volume and character. Dissertation for the degree of Candidate of medical science]. Moscow; 2009.

50. Vorobey A.V., Shuleyko A.Ch., Lur'e V.N. Puti uluchsheniya rezul'tatov lecheniya bol'nykh s tonkokishechnoy neprokhodimost'yu [Methods of improvement of treatment results of patients with small bowel obstruction]. *Khirurgiya — Surgery* 2012; 10: 35–39.

51. Krums L.M., Sabel'nikova E.A. Sindrom korotkoy tonkoy kishki: aktual'nye voprosy patogeneza, kliniki i lecheniya [Short small bowel syndrome: relevant problems of pathogenesis, clinical picture and treatment]. *Consilium medicum* 2002; 2: 27–29.

52. Chupris V.G., Pelipas' Yu.V., Boyarinov D.Yu. Morfologicheskie izmeneniya v stenke tonkoy kishki pri strangulyatsionnoy kishechnoy neprokhodimosti [Morphological changes in small bowel wall in strangulated intestinal obstruction]. *Problemy biologii i meditsiny — Problems of Medicine and Biology* 2004; 38(4): 119.

53. Akcakaya A., Alimoglu O., Sahin M., Abbasoglu S.D. Ischemia-reperfusion injury following superior mesenteric artery occlusion and strangulation obstruction. *J Surg Res* 2002; 108(1): 39–43.

54. Diaz J.J. Jr., Bokhari F., Mowery N.T., Acosta J.A., et al. Guidelines for management of small bowel obstruction. *J Trauma* 2008 Jun; 64(6): 1651–1664.

55. Tamazashvili T.Sh. K voprosu odnovremennoy dekompressii razlichnykh otdelov pishchevaritel'nogo trakta [The study of simultaneous decompression of different parts of the digestive tract]. *Klinicheskaya khirurgiya — Clinical Surgery* 1986; 8: 77–78.

56. Timerbulatov V.M., Khunafin S.N., Gattarov I.Kh., et al. Klinika i khirurgicheskoe lechenie spaечноy kishechnoy neprokhodimosti [Clinical picture and surgical treatment of adhesive intestinal obstruction]. *Vestn Hir Im II Grekova — Surgery Reporter named after I.I. Grekov* 1999; 158(6): 36–39.

57. Shal'kov Yu.L., Vorozhko A.G. Intubatsiya zheludochno-kishechnogo trakta: retrospektivnaya otsenka pokazaniy i rezul'tatov

[Gastrointestinal tract intubation: retrospective assessment of indications and results]. *Ukrains'kiy zhurnal khirurgii — Ukrainian Journal of Surgery* 2011; 6(15): 85–89.

58. Abdulzhaillov M.K. Puti povysheniya effektivnosti nazointestinal'nogo drenirovaniya u bol'nykh s ostroy kishechnoy neprokhodimost'yu i peritonitom [The improvement of nasointestinal drainage efficiency in patients with acute intestinal obstruction and peritonitis]. *Khirurgiya — Surgery* 2003; 4: 39–41.

59. Fleshier P.R., Siegman M.G., Slater G.I., et al. A prospective, randomized trial of short versus long tubes in adhesive small-bowel obstruction. *Am J Surg* 1995; 4: 366–370.

60. Babaev A.A., Shishikhin A.B., Zorin P.V. Intubatsiya tonkogo kishechnika i ego lavazh ozonirovannym rastvorom v kompleksnom lechenii ostroy tonkokishechnoy neprokhodimosti. V kn.: *Materialy IX Vserossiyskogo s'ezda khirurgov* [Small bowel intubation and its lavage by ozonized solution in complex treatment of acute small bowel obstruction. In: Proceedings of IX All-Russian congress of surgeons]. Volgograd; 2000. P. 142.

61. Beyrout I., Gargouri F., Gharbi A., et al. Late post-operative adhesive small bowel occlusions. *Tunis Med* 2006; 84(1): 9–15.

62. Fazio V.W., Cohen Z., Fleshman J.W., et al. Reduction in adhesive small-bowel obstruction by Seraphim adhesion barrier after intestinal resection. *Dis Colon Rectum* 2006; 49(1): 1–11.

63. Fevang B.T., Fevang J., Lie S.A., Soreide O., et al. Long-term prognosis after operation for adhesive small bowel obstruction. *Ann Surg* 2004 Aug; 240(2): 193–201.

64. Yudin A.B., Demko A.E., Chupris V.G. Rannaya enteral'naya terapiya u bol'nykh, operirovannykh po povodu ostroy spaечноy tonkokishechnoy neprokhodimosti [Early enteric therapy in patients operated for acute adhesive small bowel obstruction]. *Voennomeditsinskiy zhurnal — Military Medical Journal* 2008; 6: 60–61.

65. Gelfand B.R., Gur'yanov V.A., Martynov A.N., et al. Profilaktika stress-povrezhdeniy zheludochno-kishechnogo trakta u bol'nykh v kriticheskikh sostoyaniyakh [Prevention of gastrointestinal stress-damages in patients in critical conditions]. *Consilium medicum* 2005; 7(6).