

DOI:

Title:	EARLY FLUID REPLACEMENT IN BOWEL OBSTRUCTION - EFFECTS ON MORTALITY
Authors:	Bogdan SOCEA Vlad Dumitru BĂLEANU Dragoș Virgil DAVIȚOIU Ovidiu Gabriel BRATU Lucian ALECU Iulian SLAVU Adrian TULIN Mihai DIMITRIU Vlad Denis CONSTANTIN

Section: MEDICAL SCIENCES

Issue: 1(19)/2020

Received: 16 January 2020	Revised: 02 February 2020
Accepted: 8 February 2020	Available Online: 15 March 2020

Paper available online [HERE](#)

EARLY FLUID REPLACEMENT IN BOWEL OBSTRUCTION - EFFECTS ON MORTALITY

Bogdan SOCEA¹
Vlad Dumitru BĂLEANU²
Dragoș Virgil DAVIȚOIU³
Ovidiu Gabriel BRATU⁴
Lucian ALECU⁵

Iulian SLAVU⁶
Adrian TULIN⁷
Mihai DIMITRIU⁸
Vlad Denis CONSTANTIN⁹

ABSTRACT:

ACUTE INTESTINAL OBSTRUCTION OCCURS WHENEVER THERE IS ANY INTERRUPTION IN THE NORMAL FLOW OF INTESTINAL CONTENTS. MANAGEMENT OF INTESTINAL OBSTRUCTION IS AIMED TO PRIMARILY CORRECT THE PHYSIOPATHOLOGIC CHANGES CAUSED BY THE OBSTRUCTION ITSELF AND THEN, IF POSSIBLE, REMOVING THE SOURCE OF OBSTRUCTION. THE FORMER THERAPEUTIC ACTION IS ACCOMPLISHED BY INTRAVENOUS FLUID RESUSCITATION WITH INTRAVASCULAR ISOTONIC FLUIDS. EARLY FLUID REPLACEMENT PROVED AN IMPORTANT FACTOR TO REDUCE POSTOPERATIVE MORTALITY, ESPECIALLY IN THE ELDERLY. CRYSTALLOID SOLUTIONS SEEM TO BE THE BEST OPTION FOR VOLEMIC INITIAL RESUSCITATION.

KEY WORDS: FLUID REPLACEMENT, FLUID RESUSCITATION, BOWEL OBSTRUCTION

¹ University of Medicine and Pharmacy Carol Davila, 8 Eroii Sanitari Str, 050474, Bucharest, Romania, "Sf. Pantelimon" Emergency Clinical Hospital, General Surgery Department, 340 Sos. Pantelimon, 021659, Bucharest, Romania

² "Sf. Pantelimon" Emergency Clinical Hospital, General Surgery Department, 340 Sos. Pantelimon, 021659, Bucharest, Romania; University of Medicine and Pharmacy of Craiova, 2 Petru Rares Str., 200349, Craiova, Romania

³ University of Medicine and Pharmacy Carol Davila, 8 Eroii Sanitari Str, 050474, Bucharest, Romania, "Sf. Pantelimon" Emergency Clinical Hospital, General Surgery Department, 340 Sos. Pantelimon, 021659, Bucharest, Romania

⁴ University of Medicine and Pharmacy Carol Davila, 8 Eroii Sanitari Str, 050474, Bucharest, Romania; Carol Davila University Emergency Central Emergency Military Hospital, 88 Mircea Vulcanescu Str, 010825, Bucharest, Romania; Academy of Romanian Scientists, 54 Splaiul Independentei, 050085, Bucharest, Romania

⁵ General Surgery Clinic, Prof. Dr."Agrippa Ionescu" Emergency Clinical Hospital, Bucharest, Romania

⁶ General Surgery Clinic, Emergency Clinical Hospital "Floreasca", Bucharest, Romania

⁷ General Surgery Clinic, Prof. Dr."Agrippa Ionescu" Emergency Clinical Hospital, Bucharest, Romania

⁸ University of Medicine and Pharmacy Carol Davila, 8 Eroii Sanitari Str, 050474, Bucharest, Romania, "Sf. Pantelimon" Emergency Clinical Hospital, Obstetrics and Gynecology Department, 340 Sos. Pantelimon, 021659, Bucharest, Romania

⁹ University of Medicine and Pharmacy Carol Davila, 8 Eroii Sanitari Str, 050474, Bucharest, Romania, "Sf. Pantelimon" Emergency Clinical Hospital, General Surgery Department, 340 Sos. Pantelimon, 021659, Bucharest, Romania

INTRODUCTION

Acute intestinal obstruction occurs whenever there is any interruption in the normal flow of intestinal contents. Management of intestinal obstruction is aimed to primarily correct the physiopathologic changes caused by the obstruction itself and then, if possible, removing the source of obstruction. The former therapeutic action is accomplished by intravenous fluid resuscitation with intravascular isotonic fluids. We can easily evaluate the efficiency of resuscitation by a minimum gesture, the use of a bladder catheter to closely monitor urine output. Monitoring central venous pressure on the venous catheter has also proven to be very useful in the certification of vascular refill. Loss of fluid is directly proportional to the time of evolution of occlusion and with age. Decompensations from fluid extravasation are more important in the elderly. Several studies investigated the effects of rapid water re-balancing on mortality and found that it was significantly reduced to the elderly group.

MAIN TEXT

Refluxing of the vascular bed has an important and immediate effect on vascular perfusion in the mesenteric area. It rapidly improves circulation in this territory, and ischemic phenomena diminish. The effect is all the more important in a territory with preexisting mesenteric ischemia (in generalized atherosclerosis). It is known that the intestinal wall can undergo irreversible ischemic changes within a few hours, and the most sensitive layer is mucous. Thus, a quick corrective intervention can have major positive effects.

In some experimental studies in animals with intestinal occlusion, vascular bed replenishment improved blood pressure, increased blood flow to the mesenteric territory and thus limited ischemic bowel lesions, especially in the mucosa¹⁰.

Over time, the studies of the pathophysiology of intestinal occlusions has been attempted. All the results converge to the balance of fluids, which plays the most important role in this pathology. At the origin of the fluid losses in the intestinal occlusion is the inflammation that occurs in the small bowel wall. In this context, the liquids extravasate into the intestinal lumen and into the peritoneal cavity, leaving the vascular bed¹¹. Vomiting also contributes to worsening dehydration. Also, the absorptive function of the intestine is abolished if the intestinal transit is stopped.

Bowel obstructions are some of the most frequent emergencies in general surgery, commonly affecting elderly patients. Morbidity and mortality from bowel obstruction in elderly are very high¹². In fact, any emergency surgery has high mortality and morbidity in elderly¹³.

Most common causes of bowel obstruction are tumors, hernias and adhesions, which are present in more than 90% of cases¹⁴. Adhesions resulting from previous operations are

¹⁰ Fevang, J; Øvrebø, K; Grong, K; Svanes, K. *Fluid resuscitation improves intestinal blood flow and reduces the mucosal damage associated with strangulation obstruction in pigs*. J Surg Res. 2004 Apr; 117(2): 187-94

¹¹ Nellgård, P; Cassuto, J. *Inflammation as a major cause of fluid losses in small-bowel obstruction*. Scand J Gastroenterol. 1993 Dec; 28(12): 1035-41

¹² Ozturk, E; van Iersel, M; Stommel, MM; Schoon, Y; Ten Broek, RR; van Goor, H. *Small bowel obstruction in the elderly: a plea for comprehensive acute geriatric care*. World J Emerg Surg. 2018 Oct 20; 13:48

¹³ Scott, JW; Olufajo, OA; Brat, GA; Rose, JA; Zogg, CK; Haider, AH; et al. *Use of national burden to define operative emergency general surgery*. JAMA surgery. 2016; 151(6):e160480

¹⁴ Constantin, Vlad; Carâp, Alexandru; Bobic, Simona; Păun, Ion; Brătilă, Elvira; Socea, Bogdan; Moroşanu, Ana-Maria; Mirancea, Nicolae; *Accurate diagnosis of sigmoid colon endometriosis by immunohistochemistry and transmission electron microscopy - a case report*. Chirurgia, 2015, 110(5): 482-485; Bobic, Simona; Socea, Bogdan; Bratu, Ovidiu Gabriel; Stanescu, AMA; Baleanu, Vlad Dumitru; Davitoiu, Dragos Virgil; Dimitriu,

responsible for approximately two thirds of small bowel obstructions¹⁵. Some operations have higher risks of adhesion forming: appendectomies, colorectal surgery, gynecologic procedures, incisional hernia repair. Obstructions secondary to neoplasm is more common in large bowel occlusion in elderly patients. Other rare causes include: inflammatory bowel disease, intestinal intussusception, volvulus, gallstones¹⁶.

Considering the extravasation of the liquids from the vessels and the hemoconcentration, it explains the renal insufficiency of prerenal cause and the thromboembolic accidents. In this respect, prophylactic anticoagulant treatment measures are justifiable¹⁷. Thromboembolic risks are even higher at elderly patients, as age is an independent risk factor. Thus, rehydration becomes more important. Since the absorptive function of the small bowel is ceased and nil per os is recommended as therapeutic measures (not even liquids), the vascular refill should be made by intravenous lane.

The risk of venous thrombembolism is greater in patients with cancer¹⁸.

Some clinical trials demonstrated the benefits of esophageal Doppler-guided fluid management in colorectal surgery, focusing mainly on elective bowel resection¹⁹.

On the other hand, fluid overload could become dangerous, especially for patients with cardiac problems²⁰. This is the reason why the methods that assess hydration are also very important.

MCT; Dumitrescu, Dan; Badiu, Cristinel Dumitru; Constantin, Vlad Denis; *Extensive laparoscopic adhesiolysis: benefits and risks*. Arch Balk Med Union, 2019, 54(2): 320-324,

doi.org/10.31688/ABMU.2019.54.2.15; Bobic, Simona; Popa, Florian; Socea, Bogdan; Carap, Alexandru; Davițoiu, Dragoș; Constantin, Vlad Denis; *Blunt abdominal trauma and peritoneal adhesions*. Research and Science Today, 2018, 1(15): 119-31.

¹⁵ Taylor, MR; Lalani, N. *Adult small bowel obstruction*. Acad Emerg Med. 2013; 20(6): 528–544

¹⁶ Socea, B; Nica, AA; Bratu, OG; Diaconu, CC; Smaranda, AC; Socea, LI; Bertesteanu, SVG; Dimitriu, M; Carap, AC; Constantin, VD. *Incidental finding of a sigmoid intussusception associated with rectal prolapse – a case report*. Arch Balk Med Union, 2018, 53(1): 143-6; Spinu, D; Bratu, O; Popescu, R; Marcu, D; Radulescu, A; Mischianu, D. *Clostridium difficile-an emerging plague*. Romanian Journal of Military Medicine, 2015, 118(3): 12-15; Bobic, Simona; Socea, Bogdan; Diaconu, Camelia; Bratu, Ovidiu; Marcu, Dragoș; Manea, Maria; Bertesteanu, Șerban; Tenea Cojan, Tiberiu Stefanita; Băleanu, Vlad-Dumitru; Constantin, Vlad Denis. *The therapeutic management in colonic diverticular disease - a review*. Research and Science Today, 2018, suppl 2: 66-80; Socea, Bogdan; Dumitrescu, Dan; Bratu, Ovidiu Gabriel; Carap, Alexandru Constantin; Badiu, Dumitru Cristinel; Bolocan, Alexandra; Paduraru, Dan Nicolae; Mischianu, Dan; Constantin, Vlad Denis. *Inflammatory bowel diseases: the surgical perspective*. Modern Medicine, 2019, 26(1): 13-16; Mihalache, Daniel I.; Socea, Bogdan; Smaranda, Alexandru C.; Nica, Anca A.; Carap, Alexandru C.; Bratu, Ovidiu G.; Stanescu, Ana Maria A.; Groseanu, Florin; Dimitriu, Mihai C.T.; Constantin, Vlad D. *Surgical approach of infected mesh with entero-atmospheric fistula – a case presentation*. Archives of the Balkan Medical Union, 2019, 54(3): 591-595.

¹⁷ Safta, Andreea Nicoleta; Constantin, Vlad Denis; Socea, Laura-Ileana; Socea, Bogdan; *The efficiency of low molecular weight heparins in the prophylaxis of venous thromboembolic complications in general surgery*. Farmacia, 2012, 60(1): 127-137; Laslo, Crista L; Pantea Stoian, Anca; Socea, Bogdan; Paduraru, Dan N; Bodean, Oana; Socea, Laura I; Neagu, Tiberiu P; Stanescu, Ana Maria Alexandra; Marcu, Dragoș; Diaconu, Camelia C. *New oral anticoagulants and their reversal agents*. J Mind Med Sci. 2018; 5(2): 195-201.

¹⁸ Iorga, RA; Bratu, OG; Marcu, RD; Constantin, T; Mischianu, DLD; Socea, B; Gaman, MA; Diaconu, CC. *Venous thromboembolism in cancer patients: Still looking for answers*. Exp Ther Med. 2019 Dec; 18(6): 5026-5032

¹⁹ Mowatt, G; Houston, G; Hernández, R; et al. *Systematic review of the clinical effectiveness and cost-effectiveness of oesophageal Doppler monitoring in critically ill and high-risk surgical patients*. Health Technol Assess. 2009; 13: 1–95; Roy, N; Maw, A; Stuart-Smith, K. *Fluid optimization guided by oesophageal Doppler significantly improves bowel perfusion*. Br J Anaesth. 2011 Dec; 107(6): 1012-3.

²⁰ Manea, M; Marcu, D; Motofei, I; Socea, B; Stoian, AP; Bratu, OG; Gaman, MA; Gaman, AM; Stanescu, AMA; Nicorici, LM; Diaconu, CC. *Cardiovascular risk in patients with inflammatory bowel diseases: a review*. Rom Biotechnol Lett., 2019, 24(2): 366-373

Point-of-care ultrasound (POCUS) has become widely used as a tool to help clinicians prescribe fluid therapy, especially in Intensive Care Units. Common POCUS applications that serve as guides to fluid administration rely on assessments of the inferior vena cava to estimate preload and lung ultrasound to identify the early presence of extravascular lung water and avoid fluid over-resuscitation²¹. Pulmonary ultrasound reveal the presence of multiple B lines in cases of fluid overloading²².

Following a complex ileus, it also appears a circulation disturbance to the intestine or mesenterium. All the toxins and acidic metabolic products which emerge from the necrotic intestine are transferred through the systemic circulation to the whole body, being at the origin of systemic shock. Patients with small bowel obstruction with strangulation are at a higher risk for serious morbidity and mortality due to ischemic bowel. From the early beginning, a primary metabolic acidosis develops. With the progression of acidosis, hyperkalemia may also associate. A sanguin pH lower than 7.25 (severe acidosis) indicates a very poor prognosis.

The main goals of fluid resuscitation in bowel obstruction include volemic expansion, maintenance of adequate tissue perfusion and oxygenation. According to recently published studies, crystalloid solutions seem to be the most appropriate for initial fluid resuscitation²³. In a systematic study, resuscitation with colloids was associated with an increased absolute risk of mortality of 4%²⁴.

Another methanalysis concludes that there is no evidence from randomised controlled trials that resuscitation with colloids reduces the risk of death, compared to resuscitation with crystalloids, in patients with trauma, burns or following surgery. As colloids are not associated with an improvement in survival and are considerably more expensive than crystalloids, it is hard to see how their continued use in clinical practice can be justified²⁵.

About 60-80% of adhesive small bowel obstruction cases resolve without a surgical treatment²⁶. It is very important, but sometimes hard to identify which patients could undergo

²¹ Lee, CW; Kory, PD; Arntfield, RT. *Development of a fluid resuscitation protocol using inferior vena cava and lung ultrasound*. J Crit Care. 2016 Feb; 31(1): 96-100

²² Constantin, V; Carap, AC; Zaharia, L; Bobic, S; Ciudin, A; Brătilă, E; Vlădăreanu, V; Socea, B. *High correlation of lung ultrasound and chest X-ray after tube drainage in patients with primary spontaneous pneumothorax: can we omit X-rays for tube management?* Eur Surg, 2015, 47(4): 175-180

²³ Corrêa, TD; Rocha, LL; Pessoa, CM; Silva, E; de Assuncao, MS. *Fluid therapy for septic shock resuscitation: which fluid should be used?* Einstein (Sao Paulo). 2015 Jul-Sep; 13(3): 462-8

²⁴ Schierhout, G; Roberts, I. *Fluid resuscitation with colloid or crystalloid solutions in critically ill patients: a systematic review of randomised trials*. BMJ. 1998 Mar 28; 316(7136): 961-4

²⁵ Perel, P; Roberts, I; Ker, K. *Colloids versus crystalloids for fluid resuscitation in critically ill patients*. Cochrane Database Syst Rev. 2013 Feb 28; (2): CD000567

²⁶ Assenza, M; De Gruttola, I; Rossi, D; Castaldi, S; Falaschi, F; Giuliano, G. *Adhesions small bowel obstruction in emergency setting: conservative or operative treatment?* G Chir. 2016 Jul-Aug; 37(4): 145-149; Socea, Bogdan; Smaranda, Cristian A.; Nica, Anca A.; Carâp, Alexandru C.; Dimitriu, Mihai; Socea, Laura I.; Bratu, Ovidiu G.; Dumitrescu, Dan; Berteșteanu, Șerban V.G.; Constantin, Vlad D.. *Rare small bowel obstruction due to phytobezoar – Case presentation*. Archives of the Balkan Medical Union, 2017, 52(4): 458-461; Socea, Bogdan; Bratu, Ovidiu; Diaconu, Camelia; Socea, Laura I.; Dimitriu, Mihai; Carâp, Alexandru C.; Nica, Anca A.; Smaranda, Alexandru; Moculescu, Cezar E.; Băleanu, Vlad D.; Davițoiu, Dragoș; Constantin, Vlad D. *Does colostomy restoration increase the risk of developing a subsequent rectal cancer?* Archives of the Balkan Medical Union, 2018, 53(3): 369-372; Socea, Bogdan; Smaranda, Alexandru C.; Nica, Anca A.; Bratu, Ovidiu G.; Diaconu, Camelia C.; Băleanu, Vlad D.; Moculescu, Cezar E.; Dimitriu, Mihai; Carâp, Alexandru C.; Bobic, Simona; Constantin, Vlad D. *Non-operative management of the sigmoid volvulus – case presentation*. Archives of the Balkan Medical Union, 2018, 53(4): 619-622; Socea, Bogdan; Smaranda, Alexandru C.; Nica, Anca A.; Bratu, Ovidiu G.; Diaconu, Camelia C.; Băleanu, Vlad D.; Davițoiu, Dragoș V.; Dimitriu, Mihai;

a conservative treatment to prevent an useless surgery, with high anesthetic and surgery risks, like in elderly patients. Adequate hydration, starvation and decompression by a naso-gastric tube could be the only required measures in selected cases, that could by avoid an unnecessary intervention.

In the pathophysiology of occlusion, the correction of volemia leads to the correction of peripheral tissue perfusion. Glomerular filtration rate increases, which prevents renal failure, and furthermore prevents hepatic failure also²⁷. Increased infusion in the affected bowel (mesenteric territory) leads to a decrease in ischemic and inflammatory phenomena, which decreases the discharge of toxic degradation products into circulation, decreasing ileus and abdominal pressure²⁸ and interrupting the vicious circle.

By ensuring proper peripheral perfusion, maintaining blood pressure and renal function, vascular replenishment contributes to decreased morbidity and mortality, especially in elderly patients. By combating hemoconcentration, hydration prevents thromboembolic accidents²⁹.

CONCLUSIONS

Bowel occlusion is a debilitating condition that often requires surgical treatment. It is an emergency condition with high morbidity and mortality, especially in elderly patients. A majority of cases of small bowel obstruction of adhesive cause can be solved without surgical intervention that higher the risks. Adequate hydration, starvation and decompression can be salutary.

Intravascular hydration is a simple, easily reproducible and cheap therapeutic measure, but its effects on morbidity and mortality are important. Crystalloids seem to be the best option.

Carâp, Alexandru C.; Bobic, Simona; Constantin, Vlad D. *Postcolonoscopy acute appendicitis – our case series and a review of literature*. Archives of the Balkan Medical Union, 2018, 53(4): 599-602.

²⁷ Diaconescu, Diana; Pantea Stoian, Anca; Socea, Laura I.; Stanescu, Ana Maria A.; Iancu, Mihaela A.; Socea, Bogdan; Pituru, Silviu; Bratu, Ovidiu G.; Diaconu, Camelia C. *Hepatorenal syndrome: A review*. Archives of the Balkan Medical Union, 2018, 53(2): 239-245; Marcu, D; Bratu, O; Spînu, D; Popescu, R; Ciucă, A; Gălăman, M; Oprea, I; Mischianu, D. *Urinary system spontaneous rupture-an urological emergency*. Modern Medicine, 2016, 23(2): 164-169.

²⁸ Socea, Bogdan; Nica, Anca Andreea; Smaranda, Alexandru; Bratu, Ovidiu Gabriel; Diaconu, Camelia Cristina; Carap, Alexandru Constantin; Neagu, Tiberiu Paul; Badiu, Cristinel Dumitru; Constantin, Vlad Denis. *Abdominal compartment syndrome - a surgical emergency*. Modern Medicine, 2018, 25(4): 187-191

²⁹ Draghici, T; Negreanu, L; Bratu, OG; Stoian, AP; Socea, B; Neagu, TP; Stanescu, AMA; Manuc, D; Diaconu, CC. *Paraneoplastic syndromes in digestive tumors: a review*. Rom Biotechnol Lett. 2019; 24(5): 813-819

REFERENCES

1. **Fevang, J; Øvrebø, K; Grong, K; Svanes, K.** *Fluid resuscitation improves intestinal blood flow and reduces the mucosal damage associated with strangulation obstruction in pigs.* J Surg Res. 2004 Apr; 117(2): 187-94.
2. **Nellgård, P; Cassuto, J.** *Inflammation as a major cause of fluid losses in small-bowel obstruction.* Scand J Gastroenterol. 1993 Dec; 28(12): 1035-41.
3. **Ozturk, E; van Iersel, M; Stommel, MM; Schoon, Y; Ten Broek, RR; van Goor, H.** *Small bowel obstruction in the elderly: a plea for comprehensive acute geriatric care.* World J Emerg Surg. 2018 Oct 20; 13:48.
4. **Scott, JW; Olufajo, OA; Brat, GA; Rose, JA; Zogg, CK; Haider, AH; et al.** Use of national burden to define operative emergency general surgery. JAMA surgery. 2016; 151(6):e160480.
5. **Constantin, Vlad; Carâp, Alexandru; Bobic, Simona; Păun, Ion; Brătilă, Elvira; Socea, Bogdan; Moroşanu, Ana-Maria; Mirancea, Nicolae;** *Accurate diagnosis of sigmoid colon endometriosis by immunohistochemistry and transmission electron microscopy - a case report.* Chirurgia, 2015, 110(5): 482-485.
6. **Bobic, Simona; Socea, Bogdan; Bratu, Ovidiu Gabriel; Stanescu, AMA; Baleanu, Vlad Dumitru; Davitoiu, Dragos Virgil; Dimitriu, MCT; Dumitrescu, Dan; Badiu, Cristinel Dumitru; Constantin, Vlad Denis;** *Extensive laparoscopic adhesiolysis: benefits and risks.* Arch Balk Med Union, 2019, 54(2): 320-324, doi.org/10.31688/ABMU.2019.54.2.15.
7. **Bobic, Simona; Popa, Florian; Socea, Bogdan; Carap, Alexandru; Daviţoiu, Dragoş; Constantin, Vlad Denis;** *Blunt abdominal trauma and peritoneal adhesions.* Research and Science Today, 2018, 1(15): 119-31.
8. **Taylor, MR; Lalani, N.** *Adult small bowel obstruction.* Acad Emerg Med. 2013; 20(6): 528-544.
9. **Socea, B; Nica, AA; Bratu, OG; Diaconu, CC; Smaranda, AC; Socea, LI; Bertesteanu, SVG; Dimitriu, M; Carap, AC; Constantin, VD.** *Incidental finding of a sigmoid intussusception associated with rectal prolapse – a case report.* Arch Balk Med Union, 2018, 53(1): 143-6.
10. **Spinu, D; Bratu, O; Popescu, R; Marcu, D; Radulescu, A; Mischianu, D.** *Clostridium difficile-an emerging plague.* Romanian Journal of Military Medicine, 2015, 118(3): 12-15.
11. **Bobic, Simona; Socea, Bogdan; Diaconu, Camelia; Bratu, Ovidiu; Marcu, Dragoş; Manea, Maria; Bertesteanu, Şerban; Tenea Cojan, Tiberiu Stefanita; Băleanu, Vlad-Dumitru; Constantin, Vlad Denis.** *The therapeutic management in colonic diverticular disease - a review.* Research and Science Today, 2018, suppl 2: 66-80.
12. **Socea, Bogdan; Dumitrescu, Dan; Bratu, Ovidiu Gabriel; Carap, Alexandru Constantin; Badiu, Dumitru Cristinel; Bolocan, Alexandra; Padurararu, Dan Nicolae; Mischianu, Dan; Constantin, Vlad Denis.** *Inflammatory bowel diseases: the surgical perspective.* Modern Medicine, 2019, 26(1): 13-16.
13. **Mihalache, Daniel I.; Socea, Bogdan; Smaranda, Alexandru C.; Nica, Anca A.; Carap, Alexandru C.; Bratu, Ovidiu G.; Stanescu, Ana Maria A.; Groseanu, Florin; Dimitriu, Mihai C.T.; Constantin, Vlad D.** *Surgical approach of infected mesh with entero-atmospheric fistula – a case presentation.* Archives of the Balkan Medical Union, 2019, 54(3): 591-595.
14. **Safta, Andreea Nicoleta; Constantin, Vlad Denis; Socea, Laura-Ileana; Socea, Bogdan;** *The efficiency of low molecular weight heparins in the prophylaxis of venous thromboembolic complications in general surgery.* Farmacia, 2012, 60(1): 127-137.
15. **Laslo, Crista L; Pantea Stoian, Anca; Socea, Bogdan; Padurararu, Dan N; Bodean, Oana; Socea, Laura I; Neagu, Tiberiu P; Stanescu, Ana Maria Alexandra; Marcu, Dragoş; Diaconu, Camelia C.** *New oral anticoagulants and their reversal agents.* J Mind Med Sci. 2018; 5(2): 195-201.
16. **Iorga, RA; Bratu, OG; Marcu, RD; Constantin, T; Mischianu, DLD; Socea, B; Gaman, MA; Diaconu, CC.** *Venous thromboembolism in cancer patients: Still looking for answers.* Exp Ther Med. 2019 Dec; 18(6): 5026-5032.
17. **Mowatt, G; Houston, G; Hernández, R; et al.** *Systematic review of the clinical effectiveness and cost-effectiveness of oesophageal Doppler monitoring in critically ill and high-risk surgical patients.* Health Technol Assess. 2009; 13: 1-95.

18. Roy, N; Maw, A; Stuart-Smith, K. *Fluid optimization guided by oesophageal Doppler significantly improves bowel perfusion.* Br J Anaesth. 2011 Dec; 107(6): 1012-3.
19. Manea, M; Marcu, D; Motofei, I; Socea, B; Stoian, AP; Bratu, OG; Gaman, MA; Gaman, AM; Stanescu, AMA; Nicorici, LM; Diaconu, CC. *Cardiovascular risk in patients with inflammatory bowel diseases: a review.* Rom Biotechnol Lett., 2019, 24(2): 366-373.
20. Lee, CW; Kory, PD; Arntfield, RT. *Development of a fluid resuscitation protocol using inferior vena cava and lung ultrasound.* J Crit Care. 2016 Feb; 31(1): 96-100.
21. Constantin, V; Carap, AC; Zaharia, L; Bobic, S; Ciudin, A; Brătîlă, E; Vlădăreanu, V; Socea, B. *High correlation of lung ultrasound and chest X-ray after tube drainage in patients with primary spontaneous pneumothorax: can we omit X-rays for tube management?* Eur Surg, 2015, 47(4): 175-180.
22. Corrêa, TD; Rocha, LL; Pessoa, CM; Silva, E; de Assuncao, MS. *Fluid therapy for septic shock resuscitation: which fluid should be used?* Einstein (Sao Paulo). 2015 Jul-Sep; 13(3): 462-8.
23. Schierhout, G; Roberts, I. *Fluid resuscitation with colloid or crystalloid solutions in critically ill patients: a systematic review of randomised trials.* BMJ. 1998 Mar 28; 316(7136): 961-4.
24. Perel, P; Roberts, I; Ker, K. *Colloids versus crystalloids for fluid resuscitation in critically ill patients.* Cochrane Database Syst Rev. 2013 Feb 28; (2): CD000567.
25. Assenza, M; De Gruttola, I; Rossi, D; Castaldi, S; Falaschi, F; Giuliano, G. *Adhesions small bowel obstruction in emergency setting: conservative or operative treatment?* G Chir. 2016 Jul-Aug; 37(4): 145-149.
26. Socea, Bogdan; Smaranda, Cristian A.; Nica, Anca A.; Carâp, Alexandru C.; Dimitriu, Mihai; Socea, Laura I.; Bratu, Ovidiu G.; Dumitrescu, Dan; Berteşteanu, Şerban V.G.; Constantin, Vlad D.. *Rare small bowel obstruction due to phytobezoar – Case presentation.* Archives of the Balkan Medical Union, 2017, 52(4): 458-461.
27. Socea, Bogdan; Bratu, Ovidiu; Diaconu, Camelia; Socea, Laura I.; Dimitriu, Mihai; Carâp, Alexandru C.; Nica, Anca A.; Smaranda, Alexandru; Moculescu, Cezar E.; Băleanu, Vlad D.; Daviţoiu, Dragoş; Constantin, Vlad D. *Does colostomy restoration increase the risk of developing a subsequent rectal cancer?* Archives of the Balkan Medical Union, 2018, 53(3): 369-372.
28. Socea, Bogdan; Smaranda, Alexandru C.; Nica, Anca A.; Bratu, Ovidiu G.; Diaconu, Camelia C.; Băleanu, Vlad D.; Moculescu, Cezar E.; Dimitriu, Mihai; Carâp, Alexandru C.; Bobic, Simona; Constantin, Vlad D. *Non-operative management of the sigmoid volvulus – case presentation.* Archives of the Balkan Medical Union, 2018, 53(4): 619-622.
29. Socea, Bogdan; Smaranda, Alexandru C.; Nica, Anca A.; Bratu, Ovidiu G.; Diaconu, Camelia C.; Băleanu, Vlad D.; Daviţoiu, Dragoş V.; Dimitriu, Mihai; Carâp, Alexandru C.; Bobic, Simona; Constantin, Vlad D. *Postcolonoscopy acute appendicitis – our case series and a review of literature.* Archives of the Balkan Medical Union, 2018, 53(4): 599-602.
30. Diaconescu, Diana; Pantea Stoian, Anca; Socea, Laura I.; Stanescu, Ana Maria A.; Iancu, Mihaela A.; Socea, Bogdan; Pituru, Silviu; Bratu, Ovidiu G.; Diaconu, Camelia C. *Hepatorenal syndrome: A review.* Archives of the Balkan Medical Union, 2018, 53(2): 239-245.
31. Marcu, D; Bratu, O; Spînu, D; Popescu, R; Ciucă, A; Gălăman, M; Oprea, I; Mischianu, D. *Urinary system spontaneous rupture-an urological emergency.* Modern Medicine, 2016, 23(2): 164-169.
32. Socea, Bogdan; Nica, Anca Andreea; Smaranda, Alexandru; Bratu, Ovidiu Gabriel; Diaconu, Camelia Cristina; Carap, Alexandru Constantin; Neagu, Tiberiu Paul; Badiu, Cristinel Dumitru; Constantin, Vlad Denis. *Abdominal compartment syndrome - a surgical emergency.* Modern Medicine, 2018, 25(4): 187-191.
33. Draghici, T; Negreanu, L; Bratu, OG; Stoian, AP; Socea, B; Neagu, TP; Stanescu, AMA; Manuc, D; Diaconu, CC. *Paraneoplastic syndromes in digestive tumors: a review.* Rom Biotechnol Lett. 2019; 24(5): 813-819.