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Revisión Narrativa

Fluid use in the scheduled surgical patient

Uso de líquidos en el paciente quirúrgico programado

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Fluid administration is almost universally accepted as a part of the treatment of any hospitalized patient, but this is based on old perspectives and an incomplete understanding of the intravenous fluid dynamics. A long time ago Shires et al described and defined a "third space" which is a nonfunctional fluid that can be considered a fluid loss and must be replaced; this understanding led to over reanimation[1, 2]. The surgical scheduled patient is a perfect example, most of those procedures don't compromise the oral route, don't imply large fluid loses, and don't need large intravenous fluids even in complex cases like congenital heart defects[3, 4].

The lack of understanding has led to persistent overuse of intravenous fluids. New evidence suggests that the fluid response for hypotension is not the rule, but an exception to the rule in a specific situation. There is even evidence that the excretion of crystalloid fluid during hypotension is diminished and implies an increased risk of overload. Hanh conducted a trial in which 30 volunteers and 48 anesthetized patients received a single fluid bolus of lactated or acetated Ringer's solution over 30 minutes and took samples every 5 minutes for the first 30 minutes and then every 10-15 minutes. Using clinical monitoring and computerised analysis they ascertained that the rate of elimination of crystalloid fluid decreased with the mean arterial pressure (MAP) and patient age, the elimination rate constant was 6.5 (95% confidence interval, 5.2–7.9) × 10−3 × (MAP/mean MAP)5.2 × (Age/mean Age)−1.5. they concluded that the rate of elimination of crystalloid fluid decreased in proportion to MAP but was independent of general anaesthesia and moderate-sized surgery[5].

The present evidence indicates that intravenous fluids can be deleterious for critically ill patients including sepsis, trauma, and anaphylaxis[6, 7, 8].

Is undoubtedly true that this is the same for the non-critically ill patient, there are evidence and recommendations for this, including the Enhanced Recovery After Surgery (ERAS) protocols that include many recommendations including late intravenous fluid therapy and early intravenous fluid withdrawal. The implementation and adherence of these recommendations has been largely ignored by most hospitals worldwide[9].One of the biggest problems with the use of solutions for reanimation is the concept of oxygen delivery, the solutions cannot provide oxygen delivery and then it is not probable that those interventions can improve perfusion[10].

The current management of intravenous (IV) fluids in surgery involves maintaining hydration, hydro-electrolytic balance, macro, and micro-circulation, returning intracellular fluid volume to normal, and replacing ongoing losses[11].

The choice between different fluids, their dosage, management, and monitoring remain controversial, but the use of balanced crystalloids seems to be the best approach; newer evidence cannot find a difference, but it is apparently related to the lower infused volume compared with previous studies[12, 13].

In an observational study on fluid therapy management in surgical 6314 adult patients, the most widely used fluid was balanced crystalloids. The study found that hourly surgery volume tended to be more restrictive in high-risk patients with 5% of the patients receiving advanced fluid monitoring in the intraoperative setting, and 10% of the postoperative patients, confirming hardly any monitoring in the fluid therapy outside the intensive care unit.

The ERAS[14] protocol bundle has showed excellent results improving outcomes, but individual impact of each intervention is not fully established. In 2011, Gustafsson *et al.* performed a single centre prospective cohort study before and after the reinforcement of ERAS protocol, focusing on the effect of various ERAS elements including 114 variables, and nine hundred and fifty-three consecutive patients with colorectal cancer: 464 patients treated in 2002 to 2004 and 489 in 2005 to 2007. The most relevant finding was that the fluids given before the day of the surgery and the use of preoperative carbohydrate load were major independent predictors of postoperative outcomes. They found that for each additional litre of fluids given during the day of operation, the risk of postoperative symptoms delaying recovery increased by 16% (OR, 1.16; 95% CI, 1.02-1.31) and the probability of postoperative complications increased by 32% (OR, 1.32; 95% CI, 1.17-1.50). Fluid overload increased the risk of cardiorespiratory complications (OR, 1.20; 95% CI, 1.10-1.31)[15, 9].

The ASER (American Society for Enhanced Recovery) and POQI (Perioperative Quality Initiative) joint consensus statement on perioperative fluid management within an enhanced recovery pathway for colorectal surgery recommend unrestricted clear fluids for oral intake up to 2 hours before the induction as well as recommending adding at least 45g of carbohydrate to improve insulin sensitivity, while recommending against the administration of intravenous fluids to replace preoperative fluid losses after bowel preparation with iso-osmotic preparations; noting that there is no evidence that iso-osmotic mechanical bowel preparation leads to adverse effects on preoperative volume status[16].

The type of fluids administered during surgery independent of the surgical specialty must be individualized according to the anatomical site of surgery; the patient's clinical status, and the type of surgery performed, respecting contraindications, and selecting the best place for care[14, 17, 18].

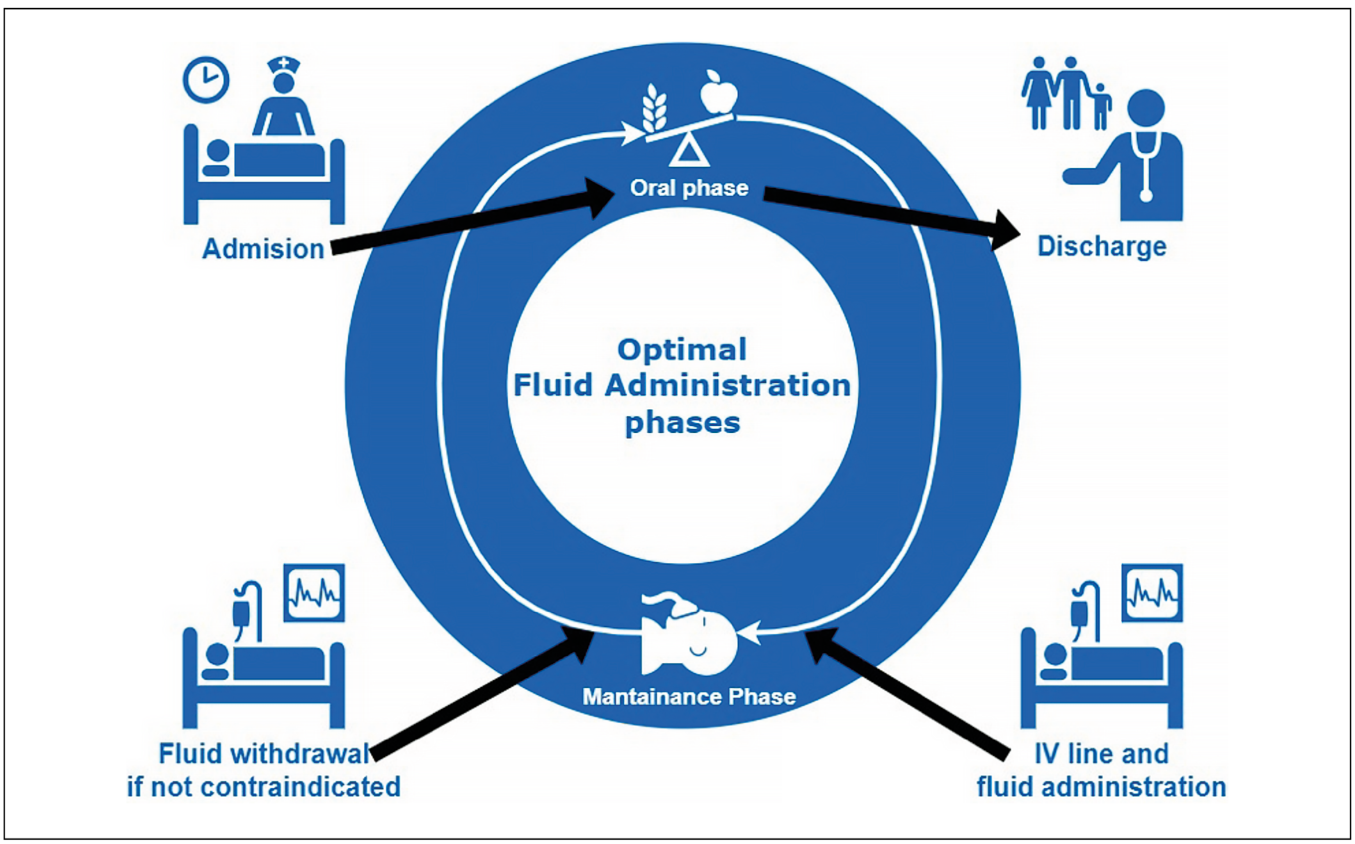

Figure 1. Proposed phases of fluid use in the scheduled surgical patient, reducing administration to specific situations and promoting the oral route.

What's the best approach?

We know from diverse sources that restrictive strategies improve outcomes for surgical patients in different specialties, and overload worsens the outcomes[19].

Malbrain *et al.*[20] explain the approach to fluid therapy in 4 stages, for the scheduled patient a similar approach can be used, but there is no need for reanimation and usually no need for optimization because the scheduled patient does not have hypotension. Also, the de-reanimation phase is not needed if no large fluid volumes were used. Three phases are proposed, oral phase, maintenance phase and second oral phase. (Figure 1)

The type of fluids administered during surgery can vary based on the patient's physiological conditions, type of surgery performed, and the clinical status of the patient[21, 11, 14, 17, 22], even differences between balanced crystalloids and 0.9% saline varies according to the procedure for example, in total hip arthroplasty, the use of crystalloids and colloids has been reported, with no significant differences in outcomes, in contrast, in total knee arthroplasty, the use of crystalloids has been reported to be more effective than colloids[18], the RELIEF study showed that a totally restrictive strategy increases the risk of acute kidney injury than those in the liberal fluid group (8.6% vs. 5%, $P < 0.001$) in this study the restrictive regimen led to a median of 1.7 L of fluid administered intraoperatively, and 3 L with the liberal regimen a moderately liberal fluid with slightly above "zero-fluid" balance can improve outcomes in some surgeries[23].

Other types of major surgery not associated with such extensive fluid shifts are unlikely to need as much intraoperative IV fluid administration to achieve a moderate positive fluid balance at the end of surgery[23].

Preoperative phase (oral phase)

In critically ill patients, there is a "Resuscitation" phase – in the scheduled surgical patient this stage is not applicable. The correct evaluation of the volume status is the most important step at this point. Before the IV line is placed there is no iatrogenic fluid overload but, preexisting disease like chronic kidney failure or cardiac failure can present fluid overload at admission. BLUE protocol for lung oedema and inferior vena cava measurement or simplified versions with basal lung ultrasound and portal doppler curve evaluation are the best options for the early evaluation of fluid status[24, 25, 26, 27].

There are some patients that are dehydrated or even hypovolemic at admission[28]. The most frequently observed cause is low oral intake before the surgery, but chronic dehydration that is a very challenging diagnosis and according to some small studies can impact health outcomes specially in older patients, increases mortality and complication rate in hip fractures[29, 30], also the fluid administration in the elderly confers specific challenges, like the need for glucose administration and avoiding sodium increase.[31]

If the patient is hemodynamically stable and tolerates oral intake, dehydration can be managed by improving oral intake even in large surgeries like hip fractures, the oral route being preferred[32, 33]. When the oral route is not available the cautious administration of intravenous fluids is indicated[34, 35, 36].

The use of solutions in the pre-surgical patient in the Otolaryngology specialty is required only for the administration of drugs, like antibiotic prophylaxis, immediately before surgery and during anaesthesia. Fluids can be withdrawal when the patient's general condition allow it and oral feeding can be restarted.[37, 38]

Some procedures, like bowel preparation, can cause fluid loses, but do not cause severe dehydration and can be managed with, oral fluids until 2 hours before surgery[39, 40, 41]. Stress response is not a problem in most cases and is not really a reason to provide extra intravenous fluids[42, 43]. Preoperative haemorrhages is not really a reason to provide intravenous fluids, especially in the scheduled patient except for some procedures, but in those cases, the best option can be blood transfusion or preoperative scheduled iron reposition[44, 45]. Frequent indication for blood transfusion or iron supplementation in the scheduled patient are gynaecology patients with abnormal uterine bleeding[46, 47, 48].

Probably at this point, most scheduled surgical patients aren't candidates for intravenous fluids.

Zero fluid in the preoperative setting can improve outcomes and even reduce surgical bleeding in major abdominal surgery, but it is important to individualize treatment, because some patients can have a worse outcome with totally restrictive strategies[49, 3, 50].

Some patients with hypotension or hypoperfusion can benefit from fluid therapy, for example, a patient with no oral intake for many days and no available oral route can benefit from some fluids, this is often present in patients with cancer[51, 52, 53] in those cases, when the urine output is decreased and hypoperfusion is present, a small fluid bolus can be used, (figure 2) with close monitoring with clinical and ultrasound protocols to prevent overload[24, 27]. If the urine output increases then no further intravenous fluid boluses are recommended; infusion can be started with close monitoring. In the opposite scenario if the patients don't increase or even further decrease urine output, extensive evaluation of the volume status should be performed. Inferior vena cava measurement, VexUS and other ultrasound protocols[27, 27] should be performed to assure the patient is hypovolemic. In these cases, another fluid bolus can be attempted, if no response, no further IV boluses are necessary and can be dele-

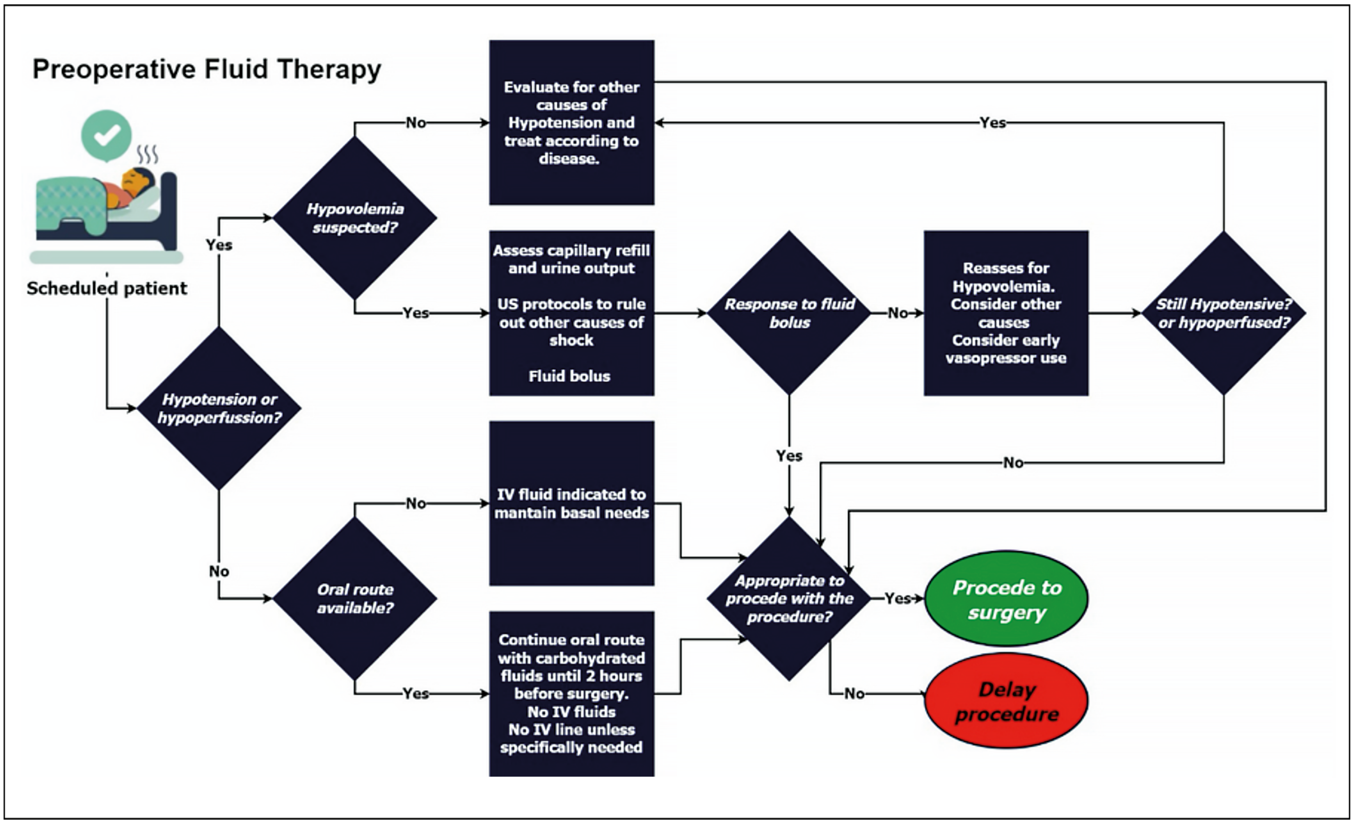

Figure 2. Preoperative assessment of hypovolemic patient to select the appropriate approach, delaying unnecessary procedures when the patient is unstable.

terious, as addressed before. The hypotensive patient is more prone to retain fluids[5], but more importantly, an injured kidney can take its time to start uresis[27, 54, 55]. Recommendations for acute kidney injury recommend performing a furosemide stress test[56], if no hypovolemia is present, and waiting as long as possible before initiating renal replacement therapy with acute kidney injury until absolute criteria is met. These recommendations are based on the slow response of the kidney to acute insults and no clinical difference in the outcomes when early or delayed renal replacement therapy is administered. (figure 3)[57, 58, 59]

Surgical phase (maintenance phase)

During the anaesthesia induction, a fluid load is a common option for treating hypotension, but the evidence on the preload strategy is contradictory, for example, a study from Yuhong found that the stroke volume can decrease as much as 62% from base line during anaesthesia induction and can be restored with crystalloids to 68% of the basal. Additional boluses can increase the stroke volume by >10% in patients with dehydration. They concluded that preload ameliorated the decrease in stroke volume, and that dehydration, but no hemodynamic response to the induction was correlated with fluid responsiveness[60], on the other hand, Rusell et al conducted a trial with 1065 critically ill patients, evaluating the incidence of cardiovascular collapse, they didn't find statistical differences with the administration of fluid bolus vs no fluid bolus with 21.0% vs 18.2% respectively. The use of push dose vasopressor if hypotension presents, but not prophylactically, is safe and a preferred practice over fluid bolus[61, 62, 63, 64], but more importantly, appropriate selection and dosing of sedatives and even vasopressors can prevent hypotension and adverse effects during induction.[65, 63]

As soon as 1990 A.J. Coe and B. RevanäsIn proved in a small open label trial that during spinal block, the use of vasopressors does not improve outcomes specially with high level block above T7. Above T4 all patients required vasopressors, and crystalloid preload has no effect in the prevention of hypotension after spinal block.[66]

Total intravenous anaesthesia (TIVA) improves the visualization of structures during endoscopic and laparoscopic surgery and reduces bleeding compared to inhaled anaesthesia and inhaled plus intravenous anaesthesia. These modalities have been studied extensively in functional endoscopic sinus surgery, other otolaryngology endoscopic and open procedures, gynaecology, and obstetrics surgery during which it may result in a cleaner surgical field and less blood loss[67, 68, 69].

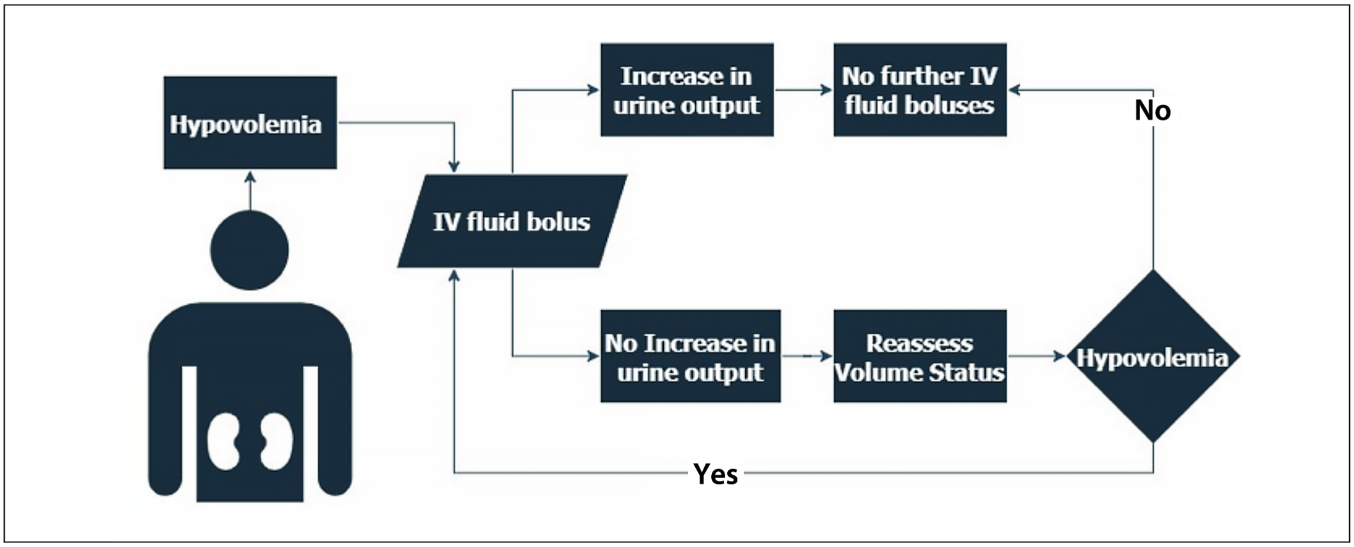

Figure 3. Hypovolemia is not always the cause of anuria, and uresis is not always improved by fluid administration, other causes must be evaluated to avoid fluid overload.

From the R.O.S.E. algorithm during surgery we are in the optimization phase, there are algorithms to use fluids. These protocolized algorithms can improve outcomes and reduce morbidity and mortality and include recommendations for intraoperative fluid restriction[9], zero balance, goal directed fluid restriction or avoidance of salt and water excess.

During surgery there the main causes of hypotension are blood lose[70], loss of sympathetic response (vasodilatation)[71] over sedation [72], chronic cardiac failure decompensation[73, 74] and non-haemorrhagic hypovolemia. Each one can be treated according to its own algorithm, and only the last one can totally respond to intravenous fluid administration. Therefore, not every hypotension during a procedure should be treated directly with fluid boluses, a correct assessment of the aetiology can improve outcomes and adequate monitoring with invasive and non-invasive techniques can help us to provide best care[75, 76].

For monitoring during the operation, there is a complex relationship that is non-linear with the blood pressure, organ perfusion and cellular function, which means that a multiparameter monitoring protocol should be the best approach including basic options like capillary refill[77, 78], non-invasive blood pressure with some interesting bias[79, 80, 81], lung ultrasound[82, 83] and invasive monitoring including central venous pressure[84, 85, 86], invasive blood pressure monitoring[87]. The correct selection of the modality of monitoring should be based on the complexity of the procedure and the patient basal and expected condition.[88, 89]

Postoperative phase (second oral phase)

Considering the R.O.S.E. concept we should be now in the Stabilization phase, at this point we can consider using fluids during the fasting time, to provide adequate hydration. For the scheduled patient, the postoperative fasting usually is short, ERAS and ESPEN protocol recommends initiating the oral intake immediately after surgery in the postoperative facilities. If there is no other indication for the intravenous route, even withdrawing the intravenous route can be the next step[39, 90, 91]. Large surgeries, like hip fracture or oncologic surgeries, can be treated only via the oral route.

Certain[92, 93, 94, 9] exceptions would contraindicate the start of the diet, such as patients with oesophageal fistulas, postoperative laryngectomies, complicated bowel surgeries, and extensive neck surgeries. These specific cases would condition continuation of the administration of antibiotics and pain management parenterally[95].

For a patient without an oral route, only maintenance fluid can be enough; boluses or high infusions are not recommended, unless there are high fluid losses during surgery, as they increase the probability of fluid overload and then local and systemic complications, including surgical site complications. A nutritional assessment is recommended after surgery and should be performed by a nutritionist[39] there are not many contraindications for avoiding the oral route: nausea or vomiting, intestinal failure,[96] failed gastrointestinal surgery[97].

Late postoperative phase

The late phase the de-escalation/de-resuscitation is a phase that should not be part of any fluid treatment algorithm, because it implies that we administered more fluid than needed for optimal management and the patient already has fluid overload. This situation carries a big risk for major complications[98], classically the perioperative management is the responsibility of the surgeon, but the anaesthesiologist is becoming the manager of the whole perioperative management[99]. The correct assessment previous to, during, and immediately after the surgery can reduce the risk of fluid overload. Point of care ultrasound, wireless monitoring, and the reemerge of the capillary refill as a reliable tool to asses perfusion[100, 101], provide the information to prevent complications associated with the fluid therapy.

For the treatment of fluid overload diuretics, classically the first line therapy in fluid overload, the loop diuretics are widely used. Furosemide inhibits tubular reabsorption of sodium and chloride in the proximal and distal tubules and the thick ascending loop of Henle results in an increased excretion of water along with sodium, chloride, magnesium, and calcium. The onset for the oral route is 1 hour, with a peak effect in 1 to 2 hours. In the bioavailability the absorption is slower than normal in patients with oedema, especially in those with cardiac failure[102]. Furosemide is useful in anuric patients as a diagnostic tool when performing a furosemide stress test to predict the need for renal replacement therapy[103, 104]. The oral route is also an option reducing the intravenous fluids administration considering the conversion: 20mg of intravenous furosemide = 40 mg of oral furosemide = 20 mg of torsemide = 1 mg of bumetanide[105].

Fluid restriction is critical from the beginning with the goal of maintaining gas exchange and organ perfusion and function, including hemodynamic stability.

Since severe complications can arise from fluid overload, for example, congestive heart failure, pulmonary oedema, delayed wound healing, tissue breakdown, and impaired bowel function, brain oedema, and even increased mortality, renal replacement therapy (extracorporeal therapies) can be used in severe non diuretic responding cases to maintain stability and optimize organ function. In this setting the accuracy of the estimation of patient's fluid status and the right use of ultrafiltration is the key to successful treatment, since the best management in acute kidney injury is still not defined the first modality needs to be based on availability of resources, local expertise, patient's hemodynamic status[106].

It is important to remember that the accumulation of fluids can produce severe complications specific to the surgical site, including surgical wound dehiscence by incrementing the vascular permeability and causing interstitial oedema and inflammation that impairs the regeneration of collagen, thereby causing weakening of the tissue incrementing the risk of wound infection, wound rupture, and anastomotic leakag [6].

Conclusions

The fluid management in the perioperative scheduled patient must be individualized, the correct analysis of the patient's situation including the actual volume status. The expected fluid loses (distinguishing blood loses from other fluid loses), the utilization of the oral route as the first option, and avoiding as much as possible the utilization of fluid infusion in patients conserving the oral route can improve outcomes. The correct monitoring according to clinical status including non-invasive devices like ultrasound and non-invasive blood pressure monitoring, as well as clinical findings like mottling and retarded capillary refill helps clinicians to select the best approach.

Mild dehydration has little to no effect in the prognosis of scheduled surgeries, on the other hand fluid overload is a major risk factor for complications. Patients with comorbidities like diabetes, hypertension, and hypothyroidism must receive the control of them before scheduled procedures. Critically ill patients are rarely candidates for scheduled procedures; delaying those procedures until disease control can prevent complications and mortality.

References

1. *Acute change in extracellular fluids associated with major surgical procedures.* T Shires, J Williams, F Brown. s.l. : Ann Surg, 1961, Vols. Nov;154(5):803-10. 10.1097/00000658-196111000-00005.
2. *Perioperative fluid administration: historical highlights and implications for practice.* Sanket Srinivasa, Andrew G Hill. s.l. : Ann Surg, 2012, Vols. Dec;256(6):1113-8. 10.1097/SLA.0b013e31825a2f22.
3. *IMMEDIATE DISCONTINUATION OF INTRAVENOUS FLUIDS AFTER COMMON SURGICAL PROCEDURES.* Naif I. Al-Awad, Lade Wosomu, Emad A.W. Al Hassanin, Abdulmohsen A. Al-Mulhim, Yaw Adu-Gyamfi, Saad M. Shawan,* and Maha S. Abdulhadi. s.l. : J Family Community Med, 2000, Vols. Jan-Apr; 7(1): 69–73. PMCID: PMC3444965.
4. *Conducting Prolonged General Anesthesia without Intravenous Access in a Child with Hypoplastic Left Heart Syndrome.* Phat T Dang, Binjon Sriratana. s.l. : Case Rep Anesthesiol, 2017, Vol. 2017:5604975. 10.1155/2017/5604975.
5. *Arterial Pressure and the Rate of Elimination of Crystalloid Fluid.* Hahn, Robert G. s.l. : Anesth Analg, 2017, Vols. 124(6):1824-1833. 10.1213/ANE.0000000000002075.
6 *Fluid therapy in the perioperative setting—a clinical review.* Voldby, A.W., Brandstrup, B. 27, s.l. : j intensive care, 2019, Vol. 4. doi.org/10.1186/s40560-016-0154-3.
7. *Fluid-induced harm in the hospital: look beyond volume and start considering sodium. From physiology towards recommendations for daily practice in hospitalized adults.* Niels Van Regenmortel, Lynn Moers, Thomas Langer, Ella Roelant, Tim De Weerdt, Pietro Caironi, Manu L. N. G. Malbrain, Paul Elbers, Tim Van den Wyngaert, Philippe G. Jorens. s.l. : Ann. Intensive Care, 2021, Vol. 79 (2021). 10.1186/s13613-021-00851-3.
8. *How to avoid fluid overload.* Ogbonna C Ogbu, David J Murphy, Greg S Martin. s.l. : Curr Opin Crit Care, 2015, Vols. 21(4):315-21. 10.1097/MCC.0000000000000211.

9. *Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations.* Gustafsson UO, Scott MJ, Hubner M, Nygren J, Demartines N, Francis N, Rockall TA, Young-Fadok TM, Hill AG, Soop M, de Boer HD, Urman RD, Chang GJ, Fichera A, Kessler H, Grass F, Whang EE, Fawcett WJ, Carli F, Lobo DN, Rollins KE, Balfour A, Baldini G, Rie. s.l. : World J Surg, 2018, Vols. 43(3):659-695. 10.1007/s00268-018-4844-y.
10. Josh, Farkas. PulmCrit: Myth-busting the fluid bolus. *EMCrit. [Online] 3 June 2019. https://emcrit.org/pulmcrit/bolus/.*
11. Neal, Matthew D. Chapter 3: Fluid and Electrolyte Management of the Surgical Patient. [book auth.] Dana K. Andersen, Timothy R. Billiar, David L. Dunn, Lillian S. Kao, John G. Hunter, Jeffrey B. Matthews, Raphael E. Pollock F. Charles Brunicardi. *Schwartz's Principles of Surgery, 11e. s.l. : McGraw Hill, 2019.*
12. *Saline versus Lactated Ringer's Solution: The Saline or Lactated Ringer's (SOLAR) Trial.* Kamal Maheshwari, Alparslan Turan, Natalya Makarova, Chao Ma, Wael Ali Sakr Esa, Kurt Ruetzler, Sabri Barsoum, Alan G. Kuhel, Michael R. Ritchey, Carlos Higuera-Rueda, Tatyana Kopyeva, Luca Stocchi, Hani Essber, Barak Cohen, Iman Suleiman, Gausan R. Bajra. s.l. : Anesthesiology, 2020, Vols. 132:614–624. doi.org/10.1097/ALN.0000000000003130.
13. *Fluid Resuscitation: Ringer Lactate Versus Normal Saline-A clinical Study.* Mane, Anil S. 11, s.l. : International Journal of Contemporary Medical Research, 2017, Vol. 4. ISSN 2393-91X.
14. *Observational study on fluid therapy management in surgical adult patients.* Colomina, M.J., Ripollés-Melchor, J., Guilabert, P. *et al.* s.l. : BMC Anesthesiol , 2021, Vols. 21, 316. doi.org/10.1186/s12871-021-01518-z.
15. *Adherence to the enhanced recovery after surgery protocol and outcomes after colorectal cancer surgery.* Ulf O Gustafsson, Jonatan Hausel, Anders Thorell, Olle Ljungqvist, Mattias Soop, Jonas Nygren and Group, Enhanced Recovery After Surgery Study. s.l. : Arch Surg, 2011, Vols. 146(5):571-7. 10.1001/archsurg.2010.309.
16. *American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on perioperative fluid management within an enhanced recovery pathway for colorectal surgery.* Robert H Thiele, Karthik Raghunathan, C S Brudney, Dileep N Lobo, Daniel Martin, Anthony Senagore, Maxime Cannesson, Tong Joo Gan, Michael Monty G Mythen, Andrew D Shaw, Timothy E Miller and W, Perioperative Quality Initiative (POQI) I. s.l. : Perioper Med (Lond), 2016, Vol. 17;5:24. 10.1186/s13741-016-0049-9.
17. *Fluid management in perioperative and critically ill patients.* Yoo, Dongho Kang and Kyung Yeon. s.l. : Acute Crit Care, 2019, Vols. 34(4): 235–245. doi: 10.4266/acc.2019.00717.
18. *Perioperative fluid management of orthopaedic patients.* Patel N, Sigamoney K, Balasubraniam D, Wigan A, Wrightington A, Leigh S. 3, s.l. : MOJ Journal of Orthopaedics & Rheumatology , 2018, Vol. 10 . DOI: 10.15406/mojor.2018.10.00419.
19. *Pathophysiology and clinical implications of perioperative fluid excess.* K. Holte, N. E. Sharrock, H. Kehlet. Issue 4, s.l. : BJA: British Journal of Anaesthesia, Vol. Volume 89. doi.org/10.1093/bja/aef220.
20. *Principles of fluid management and stewardship in septic shock: it is time to consider the four D's and the four phases of fluid therapy.* Manu L. N. G. Malbrain, Niels Van Regenmortel, Bernd Saugel, Brecht De Tavernier, Pieter-Jan Van Gaal, Olivier Joannes-Boyau, Jean-Louis Teboul, Todd W. Rice, Monty Mythen, Xavier Monnet. s.l. : Annals of Intensive Care, 2018, Vol. 66 (2018). 10.1186/s13613-018-0402-x.
21. *Postoperative fluid management.* Selami Ilgaz Kayilioglu, Tolga Dinc, Isa Sozen, Akin Bostanoglu, Mukerrem Cete, and Faruk Coskun. s.l. : World J Crit Care Med, 2015, Vols. 4(3): 192–201. doi: 10.5492/wjccm.v4.i3.192.
22. *Choice of fluid type: physiological concepts and perioperative indications.* C. Boer, S.M. Bossers, N.J. Koning. 2, s.l. : British Journal of Anaesthesia, 2018, Vol. 120. doi.org/10.1016/j.bja.2017.10.022.
23. *Restrictive versus Liberal Fluid Therapy.* P.S. Myles, R. Bellomo, T. Corcoran, A. Forbes, P. Peyton, D. Story, C. Christophi,. Massachusetts : The New England Journal of Medicine , 2018.
24. *Inferior vena cava ultrasound and other techniques for assessment of intravascular and extravascular volume: an update.* Elaine M Kaptein, Matthew J Kaptein. s.l. : Clinical Kidney Journal, 2023, Vol. sfad156. doi.org/10.1093/ckj/sfad156.
25. *Role of lung ultrasound in the preoperative evaluation of surgical patients.* Pescarissi C, Brogi E, Sidoti A, Corradi F, Forfori F. 86(7):791-793, s.l. : Minerva Anestesiol., 2020. doi: 10.23736/S0375-9393.20.14417-1.
26. *Lung ultrasonography as a tool to guide perioperative atelectasis treatment bundle in head and neck cancer patients undergoing free flap reconstructive surgeries: a preliminary observational study.* Nitika Goel a, Indu Mohini Sen a, Jaimanti Bakshi b. Issue 2, s.l. : Brazilian Journal of Otorhinolaryngology, 2022, Vol. Volume 88. doi.org/10.1016/j.bjorl.2020.05.030.
27. *Perioperative Venous Excess Ultrasound Score (VExUS) to Guide Decongestion in a Dilated Cardiomyopathy Patient Presenting for Urgent Surgery.* Keevan Singhcorresponding, Randall Carvalho. 13(12): e20545, s.l. : Cureus, 2021. doi: 10.7759/cureus.20545.
28. *Dehydration before Major Urological Surgery and the Perioperative Pattern of Plasma Creatinine: A Prospective Cohort Series.* Löffel LM, Engel DA, Beilstein CM, Hahn RG, Furrer MA, Wuethrich PY. s.l. : J Clin Med, 2021, Vol. 13;10(24):5817. 10.3390/jcm10245817.
29. *Fluid retention index predicts the 30-day mortality in geriatric care.* Johnson P, Waldreus N, Hahn RG, Stenström H, Sjöstrand F. s.l. : Scand J Clin Lab Invest, 2015, Vols. 75(6):444-51. 10.3109/00365513.2015.1039057.
30. *Preoperative urine-specific gravity and the incidence of complications after hip fracture surgery: A prospective, observational study.* Ylinenvaara SI, Elisson O, Berg K, Zdolsek JH, Krook H, Hahn RG. s.l. : Eur J Anaesthesiol, 2014, Vols. 31(2):85-90. 10.1097/01.EJA.0000435057.72303.0e.
31. *The Challenge of Perioperative Fluid Management in Elderly Patients.* Birgitte Brandstrup, Ann M. Møller. s.l. : Curr Anesthesiol Rep, 2019, Vols. 406–413 (2019). 10.1007/s40140-019-00349-6.
32. *Maintaining oral hydration in older adults in surgical wards: a best practice implementation project.* Seah KH, Low APS, Low

JY, Luk GKS, Chia HX, Goh ML. s.l. : JBI Evid Implement, 2021, Vols. 20(1):63-71. 10.1097/XEB.0000000000000289.

33. *Oral Hydration Before and After Hip Replacement: The Notion Behind Every Action.* Briguglio M, Wainwright TW, Crespi T, Southern K, Mangiavini L, Craig J, Middleton RG. s.l. : Geriatr Orthop Surg Rehabil, 2022, Vol. 13:21514593221138665. 10.1177/21514593221138665.
34. (UK), National Collaborating Centre for Women's and Children's Health. *Diarrhoea and Vomiting Caused by Gastroenteritis: Diagnosis, Assessment and Management in Children Younger than 5 Years. London : NICE Clinical Guidelines, 2009. https://www.ncbi.nlm.nih.gov/books/NBK63837/.*
35. *Postoperative Delirium in Patients with Oral Cancer: Is Intraoperative Fluid Administration a Neglected Risk Factor?* Obermeier KT, Kraus M, Smolka W, Henkel J, Saller T, Otto S, Liokatis P. s.l. : Cancers (Basel), 2022, Vol. 28;14(13):3176. 10.3390/cancers14133176.
36. *Fluid management in perioperative and critically ill patients.* Kang D, Yoo KY. s.l. : Acute Crit Care, 2019, Vols. 34(4):235-245. 10.4266/acc.2019.00717.
37. *Effects of three different types of anaesthesia on perioperative bleeding control in functional endoscopic sinus surgery.* Jarosław Miłoński 1, Hanna Zielińska-Bliźniewska, Wojciech Golusiński, Joanna Urbaniak, Rafał Sobański, Jurek Olszewski. 270(7):2045-50, s.l. : Eur Arch Otorhinolaryngol, 2013. doi: 10.1007/s00405-012-2311-.
38. *Quality of surgical field during endoscopic sinus surgery: a systematic literature review of the effect of total intravenous compared to inhalational anesthesia.* Kelly EA, Gollapudy S, Riess ML, Woehlck HJ, Loehrl TA, Poetker DM. 3(6):474-81, s.l. : Int Forum Allergy Rhinol, 2013. doi: 10.1002/alr.21125.
39. *ESPEN practical guideline: Clinical nutrition in surgery.* Arved Weimann, *et al.* s.l. : ESPEN Guideline, 2021, Vols. P4745-4761. 10.1016/j.clnu.2021.03.031.
40. *Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures: An Updated Report by the American Society of Anesthesiologists Tas.* American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. s.l. : Anesthesiology, 2017, Vols. 126:376–393. 10.1097/ALN.0000000000001452.
41. *Oral carbonhydrate 2 hours before surgery does't increase the risk of reflux and aspiration. A randomized controlled trial in volunteers.* Gang Zhang, Xiaoyan Huang, Ji Feng, Lan Zhang. s.l. : PREPRINT, 2023. 10.21203/rs.3.rs-2361859/v1.
42. *Redefining the perioperative stress response: a narrative review.* Manou-Stathopoulou V, Korbonits M, Ackland GL. s.l. : Br J Anaesth, 2019, Vols. 123(5):570-583. 10.1016/j.bja.2019.08.011.
43. *The surgically induced stress response.* Finnerty CC, Mabvuure NT, Ali A, Kozar RA, Herndon DN. s.l. : JPEN J Parenter Enteral Nutr, 2013, Vols. 37(5 Suppl):21S-9S. 10.1177/0148607113496117.
44. *Peri-operative blood management.* Eeles A, Baikady RR. s.l. : Indian J Anaesth, 2017, Vols. 61(6):456-462. 10.4103/ija.IJA_341_17.
45. *Peri-operative blood transfusion in elective major surgery: incidence, indications and outcome - an observational multicentre study.* Unal D, Senayli Y, Polat R, Spahn DR, Toraman F, Alkis N, *et al.* s.l. : Blood Transfus, 2020, Vols. 18(4):261-279. 10.2450/2020.0011-20.
46. *Iron Deficiency Anemia with Menorrhagia: Ferric Carboxymaltose a Safer Alternative to Blood Transfusion.* Vineet Mishra, Ruchika Verneker, Khushali Gandhi, Sumesh Choudhary, Sunita Lamba. s.l. : J Midlife Health, 2018, Vols. 9(2): 92–96. doi: 10.4103/jmh.JMH_121_17.
47. *A Review of Clinical Guidelines on the Management of Iron Deficiency and Iron-Deficiency Anemia in Women with Heavy Menstrual Bleeding.* Diana Mansour, Axel Hofmann, Kristina Gemzell-Danielsson. s.l. : Adv Ther. , 2021, Vols. 38(1): 201–225. doi: 10.1007/s12325-020-01564-y.
48. *Risk Factors Associated with Blood Transfusion in Laparoscopic Hysterectomy.* H.R. Haber, A. Pelletier, S.O.A. Leung, C. Feltmate. Issue 11, s.l. : Journal of Minimally Invasive Gynecology , 2022, Vol. Volume 29. doi.org/10.1016/j.jmig.2022.09.107.
49. *Perioperative Fluid Utilization Variability and Association With Outcomes: Considerations for Enhanced Recovery Efforts in Sample US Surgical Populations.* Thacker JK, Mountford WK, Ernst FR, Krukas MR, Mythen MM. s.l. : Ann Surg, 2016, Vols. 263(3):502-10. 10.1097/SLA.0000000000001402.
50. *Preoperative fluid retention increases blood loss during major open abdominal surgery.* Robert G. Hahn, Hans Bahlmann, and Lena Nilsson. s.l. : Perioperative Medicine , 2017, Vol. 6:12. DOI 10.1186/s13741-017-0068-1.
51. *Perioperative restricted fluid therapy preserves immunological function in patients with colorectal cancer.* Jie HY, Ye JL, Zhou HH, Li YX. s.l. : World J Gastroenterol, 2014, Vols. 20(42):15852-9. 10.3748/wjg.v20.i42.15852.
52. *Perioperative fluid management for major elective surgery.* N Heming, P Moine, R Coscas, D Annane. s.l. : British Journal of Surgery, 2020, Vols. Volume 107, Issue 2. 10.1002/bjs.11457.
53. *Perioperative Fluid Management in the Enhanced Recovery after Surgery (ERAS) Pathway.* Zhu AC, Agarwala A, Bao X. s.l. : Clin Colon Rectal Surg, 2019, Vols. 32(2):114-120. 10.1055/s-0038-1676476.
54. *Practical approach to detection and management of acute kidney injury in critically ill patient.* Mohsenin, Vahid. 5:57, s.l. : J Intensive Care, 2017. doi: 10.1186/s40560-017-0251-y.
55. *Fluid management in acute kidney injury.* Perner, A., Prowle, J., Joannidis, M. *et al.* s.l. : Intensive Care Med, 2017, Vol. 43. doi.org/10.1007/s00134-017-4817-x.
56. *The furosemide stress test: current use and future potential.* Chawlab, Blaithin A. McMahona and Lakhmir S. s.l. : Ren Fail, 2021, Vols. 43(1): 830–839. doi: 10.1080/0886022X.2021.1906701.
57. *Delayed versus early initiation of renal replacement therapy for severe acute kidney injury: a systematic review and individual patient data meta-analysis of randomised clinical trials.* Gaudry S, Hajage D, Benichou N, Chaïbi K, Barbar S, Zarbock A, Lumlertgul N, Wald R, Bagshaw SM, Srisawat N, Combes A, Geri G, Jamale T, Dechartres A, Quenot JP, Dreyfuss D. s.l. : Lancet, 2020, Vols. 395(10235):1506-1515. doi: 10.1016/S0140-6736(20)30531-6.
58. *Early versus delayed initiation of renal replacement therapy for acute kidney injury: an updated systematic review, meta-analysis, meta-regression and trial sequential analysis of randomized controlled trials.* Fabio Tanzillo Moreira, 1 Henrique Palomba,1

Renato Carneiro de Freitas Chaves, Catherine Bouman, Marcus Josephus Schultz, and Ary Serpa Neto. s.l. : Rev Bras Ter Intensiva, 2018, Vols. 30(3): 376–384. doi: 10.5935/0103-507X.20180054.

59. *Delayed versus early initiation of renal replacement therapy for severe acute kidney injury: a systematic review and individual patient data meta-analysis of randomised clinical trials.* Stéphane Gaudry, David Hajage, Nicolas Benichou, Khalil Chaïbi, *et al.* 10235, s.l. : Lancet, 2020, Vol. 395. doi.org/10.1016/S0140-6736(20)30531-6.
60. *Dehydration, hemodynamics and fluid volume optimization after induction of general anesthesia.* Yuhong Li, Rui He, Xiaojiang Ying, Robert G Hahn. s.l. : Clinics, 2014, Vols. Volume 69, Issue 12. 10.6061/clinics/2014(12)04.
61. *Co-induction with a vasopressor "chaser" to mitigate propofol-induced hypotension when intubating critically ill/frail patients-A questionable practice.* Ho AM, Mizubuti GB. s.l. : J Crit Care, 2019, Vols. 54:256-260. 10.1016/j.jcrc.2019.09.015.
62. *Push-Dose Pressors During Peri-intubation Hypotension in the Emergency Department: A Case Series.* Bakhsh A, Alotaibi L. s.l. : Clin Pract Cases Emerg Med, 2021, Vols. 5(4):390-393. 10.5811/cpcem.2021.4.51161.
63. *A Review of Push-Dose Vasopressors in the Peri-operative and Critical Care Setting.* McPherson KL, Kovacic Scherrer NL, Hays WB, Greco AR, Garavaglia JM. s.l. : Journal of Pharmacy Practice, 2022, Vol. 0(0). 10.1177/08971900221096967.
64. *Concerns of the anesthesiologist: anesthetic induction in severe sepsis or septic shock patients.* Yoon, Seok Hwa. s.l. : Korean Journal of Anesthesiology, 2012, Vols. 63(1):3-10. 10.4097/kjae.2012.63.1.3.
65. *Effect of induction agent on vasopressor and steroid use, and outcome in patients with septic shock.* Ray, D.C., McKeown, D.W. s.l. : Crit Care, 2007, Vol. R56 (2007). 10.1186/cc5916.
66. *Is crystalloid preloading useful in spinal anaesthesia in the elderly?* Coe, A.J. and Revanäs, B. s.l. : Anaesthesia, 1990, Vols. 45: 241-243. 10.1111/j.1365-2044.1990.tb14696.x.
67. *Impact of anesthetic agents on the amount of bleeding during dilatation and evacuation: A systematic review and meta-analysis.* Lee HA, Kawakami H, Mihara T, Sato H, Goto T. s.l. : PLoS One., 2021, Vol. 16(12):e0261494. doi: 10.1371/journal.pone.0261494.
68. *Evaluating the Role of Anesthesia on Intraoperative Blood Loss and Visibility during Endoscopic Sinus Surgery: A Meta-analysis.* Moffatt DC, McQuitty RA, Wright AE, Kamucheka TS, Haider AL, Chaaban MR. s.l. : Am J Rhinol Allergy, 2021, Vols. 35(5): 674-684. doi: 10.1177/1945892421989155.
69. *Total intravenous anesthesia improves intraoperative visualization during surgery for high-grade chronic rhinosinusitis: a double-blind randomized controlled trial.* Jacob P. Brunner, Joshua M. Levy, Melissa L. Ada, Kiranya E. Tipirneni, Henry P. Barham, Gretchen M. Oakley, Daniel R. Cox, Bobby D. Nossaman, and Edward D. McCoul,. s.l. : Int Forum Allergy Rhinol, 2019, Vols. 8(10): 1114–1122. doi: 10.1002/alr.22173.
70. *Massive hemorrhage and transfusion in the operating room.* Muirhead, B., Weiss, A.D.H. s.l. : Can J Anesth/J Can Anesth, 2017, Vols. 64, 962–978. doi.org/10.1007/s12630-017-0925-x.
71. *Perioperative haemodynamics and vasoconstriction: time for reconsideration?* Nicolai B. Foss, Henrik Kehlet. s.l. : Br J Anaesth., 2019, Vols. 123(2): 100–103. doi: 10.1016/j.bja.2019.04.052.
72. *Recognition and Management of Complications During Moderate and Deep Sedation. Part 2: Cardiovascular Considerations.* Daniel E Becker, Daniel A Haas. s.l. : Anesth Prog. , 2011, Vols. 58(3): 126–138. doi: 10.2344/0003-3006-58.3.126.
73. *The patient with chronic heart failure undergoing surgery.* Smit-Fun V, Buhre WF. s.l. : Curr Opin Anaesthesiol., 2016, Vols. 29(3):391-6. doi: 10.1097/ACO.0000000000000335.
74. *Association Between Heart Failure and Postoperative Mortality Among Patients Undergoing Ambulatory Noncardiac Surgery.* Lerman BJ, Popat RA, Assimes TL, Heidenreich PA, Wren SM. s.l. : JAMA Surg., 2019, Vols. 154(10):907–914. doi:10.1001/jamasurg.2019.2110.
75. *Perioperative Fluid Therapy for Major Surgery.* Timothy E. Miller, Paul S. Myles. s.l. : Anesthesiology, 2019, Vols. 130:825–832. doi: https://doi.org/10.1097/ALN.0000000000002603.
76. *Perioperative fluid management: From physiology to improving clinical outcomes.* Victoria A Bennett, Maurizio Cecconi. s.l. : Indian J Anaesth., 2017, Vols. 61(8): 614–621. doi: 10.4103/ija.IJA_456_17.
77. *Pulse oximetry-based capillary refilling evaluation predicts postoperative outcomes in liver transplantation: a prospective observational cohort study.* Yamamoto, M., Doi, K., Hayase, N. *et al.* 251, s.l. : BMC Anesthesiol, 2020, Vol. 20. doi.org/10.1186/s12871-020-01171-y.
78. *Capillary Refill Time and Serum Lactate as Predictors of Mortality and Postoperative Extracorporeal Membrane Oxygenation Requirement in Congenital Heart Surgery.* Gustavo Cruz, Santiago Pedroza Gómez, Akemi Arango, Paula A. Guevara, Carlos González, Jesus Aguirre, Andrea Valencia-Orozco and Antonio J. Suguimoto. s.l. : Children, 2023, Vols. 10(5), 875. doi.org/10.3390/children10050875.
79. *Perioperative Noninvasive Blood Pressure Monitoring.* Kuck K, Baker PD. s.l. : Anesth Analg, 2918, Vols. 127(2):408-411. doi: 10.1213/ANE.0000000000002619.
80. *Perioperative Automated Noninvasive Blood Pressure- (NIBP-) Related Peripheral Nerve Injuries: An Anesthetist's Dilemma—A Case Report and Review of the Literature.* Waleed Elmatite, Chanchal Mangla, Surjya Upadhyay, and Joel Yarmush. s.l. : Case Rep Anesthesiol, 2020, Vol. 2020: 5653481. doi: 10.1155/2020/5653481.
81. *The Accuracy of Perioperative Noninvasive Blood Pressure Monitoring in Obese Patients.* HP., Grocott. s.l. : Anesth Analg., 2018, Vol. 127(3):e46. doi: 10.1213/ANE.0000000000002862..
82. *Intraoperative lung ultrasound: A clinicodynamic perspective.* Gupta, Amit Kumar Mittal and Namrata. s.l. : J Anaesthesiol Clin Pharmacol. , 2016, Vols. 32(3): 288–297. doi: 10.4103/0970-9185.188824.
83. *Association between preoperative evaluation with lung ultrasound and outcome in frail elderly patients undergoing orthopedic surgery for hip fractures: study protocol for an Italian multicenter observational prospective study (LUSHIP).* Vetrugno, L., Boero, E., Bignami, E. *et al.* 30, s.l. : Ultrasound J, 2021, Vol. 13. doi.org/10.1186/s13089-021-00230-w.

84. *Optimization of central venous pressure during the perioperative period is associated with improved prognosis of high-risk operation patients.* Jiafang Wu, Jun Li, Han Chen, Xiuling Shang and Rongguo Yu. s.l. : J Intensive Med, 2023, Vols. 3(2): 165–170. doi: 10.1016/j.jointm.2022.06.003.
85. *A preoperative estimate of central venous pressure is associated with early Fontan failure.* Michael A. Quail, Ignatius Chanm, Shiv Sarna, Marina Hughes, Vivek Muthurangu. 4, s.l. : Congenital: Fontan, 2020, Vol. 161. doi.org/10.1016/j.jtcvs.2020.06.025.
86. *Intraoperative central venous pressure and acute kidney injury incidence in patients with cardiac surgery.* Lihai Chen, Yali Ge, Jiacong Liu, Jifang Zhou. s.l. : Br J Anaesth, 2023, Vols. 130: e21-e22. doi.org/10.1016/j.bja.2023.04.002.
87. *Perioperative Blood Pressure Management.* Bernd Saugel, Daniel I. Sessler. s.l. : Anesthesiology , 2021, Vols. 134:250–261 . doi.org/10.1097/ALN.0000000000003610.
88. *Perioperative Quality Initiative consensus statement on intraoperative blood pressure, risk and outcomes for elective surgery.* Daniel I. Sessler, Joshua A. Bloomstone, Solomon Aronson, *et al.* 5, s.l. : Br J Anaesth, 2019, Vol. 122. doi.org/10.1016/j.bja.2019.01.013.
89. *Blood Pressure Targets in Perioperative Care.* Lingzhong Meng, Weifeng Yu, Tianlong Wang, Lina Zhang, Paul M. Heerdt and Adrian W. Gelb. 4, s.l. : American Heart Association: Hypertension, 2018, Vol. 72. doi.org/10.1161/HYPERTENSIONAHA.118.11688.
90. *Guidelines for Perioperative Care in Elective Abdominal and Pelvic Surgery at Primary and Secondary Hospitals in Low–Middle-Income Countries (LMIC's): Enhanced Recovery After Surgery (ERAS) Society Recommendation.* Oodit, R., Biccard, B.M., Panieri, E. *et al.* s.l. : World J Surg, 2022, Vols. 1826–1843. 10.1007/s00268-022-06587-w.
91. *Enteral and Parenteral Nutrition in the Perioperative Period: State of the Art.* Salim Abunnaja, Andrea Cuviello, Juan A. Sanchez. s.l. : Nutrients, 2013, Vols. 5(2): 608–623. PMCID: PMC3635216.
92. *Intrathoracic Fluid Extravasation After Hip Arthroscopy.* Maneesh Verma, Jon K. Sekiya,. No 9, s.l. : Arthroscopy: The Journal of Arthoscopic and Related Surgery, 2010, Vol. Vol 26.
93. *Oral Hydration Before and After Hip Replacement: The Notion Behind Every Action.* Matteo Briguglio, Thomas W Wainwright, Tiziano Crespi, Kate Southern, Laura Mangiavini, James Craig, Rob G Middleton. s.l. : Geriatr Orthop Surg Rehabil. , 2022, Vol. 13: 21514593221138665. doi: 10.1177/21514593221138665.
94. *Postoperative fasting is associated with longer ICU stay in oncologic patients undergoing elective surgery.* Caroline Fachini, Claudio Z. Alan & Luciana V. Viana. s.l. : Perioperative Medicine, 2022, Vol. Article number: 29 . https://doi.org/10.1186/s13741-022-00261-4.
95. *Ear, Nose and Throat: Post Operative Management and Care. Practice Guideline.* Network, The Sydney Children´s Hospital. s.l. : The Sydney Children´s Hospital Network, 2017, Vols. : 2016-236 v1. https://www.schn.health.nsw.gov.au/_policies/pdf/2016-236.pdf.
96. *Management of acute intestinal failure: A position paper from the European Society for Clinical Nutrition and Metabolism (ESPEN) Special Interest Group.* Stanislaw Klek, Alastair Forbes, Simon Gabe, Mette Holst, *et al.* s.l. : Clinical Nutrition, 2016, Vols. 35 (2016) 1209-1218. 10.1016/j.clnu.2016.04.009.
97. *Risk factors for adverse outcomes following surgery for small bowel obstruction.* Margenthaler JA, Longo WE, Virgo KS, Johnson FE, Grossmann EM, Schifftner TL, Henderson WG, Khuri SF. s.l. : Ann Surg, 2006, Vols. 243(4):456-64. 10.1097/01.sla.0000205668.58519.76.
98. *Postoperative fluid overload is a risk factor for adverse surgical outcome in patients undergoing esophagectomy for esophageal cancer: a retrospective study in 335 patients.* Glatz T, Kulemann B, Marjanovic G, Bregenzer S, Makowiec F, Hoeppner J. s.l. : BMC Surg, 2017, Vol. 17(1):6. 10.1186/s12893-016-0203-9.
99. *Postoperative fluid therapy on the ward: another job for anaesthetists?* Geerts BF, Veelo DP. s.l. : Br J Anaesth, 2018, Vols. 120(2):205-206. 10.1016/j.bja.2017.10.016.
100. *Effect of a Resuscitation Strategy Targeting Peripheral Perfusion Status vs Serum Lactate Levels on 28-Day Mortality Among Patients With Septic Shock: The ANDROMEDA-SHOCK Randomized Clinical Trial.* Hernández G, Ospina-Tascón GA, Damiani LP, Estenssoro E, *et al.* s.l. : JAMA, 2019, Vols. 321(7):654-664. 10.1001/jama.2019.0071.
101. *Hemodynamic phenotype-based, capillary refill time-targeted resuscitation in early septic shock: The ANDROMEDA-SHOCK-2 Randomized Clinical Trial study protocol.* Kattan E, Bakker J, Estenssoro E, Ospina-Tascón GA, Cavalcanti AB, Backer D, Vieillard-Baron A, Teboul JL, Castro R, Hernández G. s.l. : Rev Bras Ter Intensiva, 2022, Vols. 34(1):96-106. 10.5935/0103-507X.20220004-pt.
102. *Furosemide absorption altered in decompensated congestive heart failure.* Vasko MR, Cartwright DB, Knochel JP, Nixon JV, Brater DC. s.l. : Ann Intern Med, 1985, Vols. 102(3):314-8. 10.7326/0003-4819-102-3-314.
103. *The furosemide stress test: current use and future potential.* Chawla, Blaithin A. McMahon and Lakhmir S. s.l. : Ren Fail., 2021, Vols. 43(1): 830–839. doi: 10.1080/0886022X.2021.1906701.
104. *The Furosemide Stress Test for Prediction of Worsening Acute Kidney Injury in Critically Ill Patients: A Multicenter, Prospective, Observational Study.* OG Rewa, 1 SM Bagshaw, X Wang, R Wald, O Smith, J Shapiro, B McMahon, KD Liu, SA Trevino, LS Chawla, and JL Koyner. s.l. : J Crit Care, 2021, Vols. 52: 109–114. . doi: 10.1016/j.jcrc.2019.04.011.
105. Khan TM, Patel R, Siddiqui AH. *Furosemide. Treasure Island (FL) : StatPearls Publishing, 2023. https://www.ncbi.nlm.nih.gov/books/NBK499921/.*
106. *Fluid overload in the ICU: evaluation and management.* Claure-Del Granado, R., Mehta, R.L. s.l. : BMC Nephrol, 2016, Vol. 109 (2016). 10.1186/s12882-016-0323-6.
107. *Wireless Monitoring Program of Patient-Centered Outcomes and Recovery Before and After Major Abdominal Cancer Surgery.* Sun V, Dumitra S, Ruel N, Lee B, Melstrom L, Melstrom K, Woo Y, Sentovich S, Singh G, Fong Y. s.l. : JAMA Surg, 2017, Vols. 152(9):852-859. 10.1001/jamasurg.2017.1519.
108. *Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations.* Gustafsson, U.O., Scott, M.J., Hubner, M. *et al.* s.l. : World J Surg, 2018, Vols. 43, 659–695 (2019). doi.org/10.1007/s00268-018-4844-y.