J Anal Res Clin Med, 2016, 4(1), 14-9.
doi: 10.15171/jarcm.2016.003, *http://journals.tbzmed.ac.ir/JARCM*

Original Article

Evaluating effects of pre-operative hydration on clinical outcome of patients undergoing orthopedic surgery

Mohammadreza Bazavar[1], Hossein Aslani[2], Asghar Elmi[2], Ali Sadighi[2], Ali Tabrizi[*3]

[1] *Assistant Professor, Department of Orthopedic Surgery, School of Medicine AND Shohada Educational Hospital, Tabriz University of Medical Sciences, Tabriz, Iran*

[2] *Associate Professor, Department of Orthopedic Surgery, School of Medicine AND Shohada Educational Hospital, Tabriz University of Medical Sciences, Tabriz, Iran*

[3] *Assistant Professor, Department of Orthopedic Surgery, School of Medicine AND Emam Khomeini Educational Hospital, Urmia University of Medical Sciences, Urmia, Iran*

Article info
Article History:
Received: 20 Sep 2015
Accepted: 08 Dec 2015
ePublished: 29 Feb 2016

Keywords:
Orthopedic Surgery,
Pre-operative Hydration,
Outcome,
Hospital Admission

Abstract

Introduction: Hydration is necessary for surgery, and it is recommended that pre-operative hydration may accompany with better outcome and shorter post-operative hospitalization. This study aims at evaluating effects of pre-operative hydration on clinical outcome of patients undergoing orthopedic surgery.

Methods: In this case-control study, 100 patients undergoing lower limb orthopedic surgery were randomly classified as intervention group (pre-operative hydration, n = 50) and control group (no pre-operative hydration, n = 50). The intervention group received crystalloid fluids (ringer) 1.5 ml/kg during fasting, and the control group received no intravenous fluid before surgery. Both groups were evaluated for intraoperative and post-operative findings.

Results: Comparing with the control group, the intervention group had significantly lower hypotension during surgery (10 vs. 38%, P = 0.001), less hemodynamic disorder (8 vs. 30%, P = 0.005), less need for pack cell transfusion (12 vs. 60%, P < 0.001), higher urine output (1047.68 ± 586.78 vs. 750.36 ± 437.25 cc, P = 0.005), less intensive care unit (ICU) admission (12 vs. 30%, P = 0.020), and shorter mean hospitalization (6.96 ± 1.78 vs. 8.96 ± 3.10 days, P < 0.001). There was no significant difference between the groups considering mortality rate (4 vs. 6%, P = 0.100).

Conclusion: Pre-operative hydration improves patient's status during surgery, reduces hypotension, and duration of hospitalization.

Citation: Bazavar M, Aslani H, Elmi A, Sadighi A, Tabrizi A. **Evaluating effects of pre-operative hydration on clinical outcome of patients undergoing orthopedic surgery.** J Anal Res Clin Med 2016; 4(1): 14-9. Doi: 10.15171/jarcm.2016.003

Introduction

Although fluid therapy is necessary in invasive measures and anesthesia process, its type, quantity, and exact time of prescription are still a question. Almost all patients undergoing general anesthesia will receive some intravenous fluid. There are ever-increasing evidence indicating that pre-operative fluid therapy affects long-term post-operative outcomes. Routine treatment process, i.e., intravenous injection of higher crystalloid volumes for all patients, was investigated through recent trial and evidence-based studies.[1-5] The operated patients are exposed to decrease of tissue perfusion or increase of body fluids.

* **Corresponding Author:** Ali Tabrizi, Email: dr.tabrizi.ali@hotmail.com

© 2016 The Authors; Tabriz University of Medical Sciences
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Speaking about fluid therapy in surgery, three points should be taken into account: hypovolemia, hypervolemia, and tissue perfusion.[6-10]

In hypovolemia, the patients encounter decreases of tissue perfusion, and their different organs are damaged during or after surgery.[6-9] The increase of body fluids and retention of fluids after surgery results in hypervolemia and it leads to the longer intensive care unit (ICU) admission and more post-operative mortality rate.[10] There are more contradictions about pre-operative hydration, its quality, and clinical outcome of the patients. Cardiac and pulmonary function, tissue oxygenation, healing of wounds, post-operative ileus, renal function, and coagulation conditions may be affected by pre-operative fluid therapy.[11] According to recent studies, pre-operative hydration does not affect osmolality of the fasting operated patients, and the prescribed crystalloid fluids are not successful in preventing from hypotension during anesthesia.[12] However, other studies believe that prescribing appropriate volume of pre-operative intravenous fluids may be helpful in improving post-operative outcome.[13]

This study assumes that pre-operative crystalloid fluids may improve recovery process of the patients and decrease the need to use blood products during surgery. Therefore, the present study evaluates effects of pre-operative hydration on clinical outcome of patients undergoing orthopedic surgery.

Methods

This case-control study was conducted on 100 patients underwent orthopedic surgeries in Shohada Hospital, affiliated by Tabriz University of Medical Sciences, Iran. Patients with lower limb fractures (hip and femur shaft) where there is not necessary to use a tourniquet as well as patients without any records of systemic disease such as diabetes, cardiac, and renal diseases were qualified to enter the study. Patients were included with long bone lower fractures need to surgical fixation, who were not need to blood transfusion before the operation, without systemic and metabolic disease, no solid organ damage or multilevel fractures.

The patients were randomly classified as case and control groups (n = 50) and compared. Patients of both groups were matched considering age, gender, and kind of surgery. According to surgery protocol of the hospital, both groups were fasting for 12 hours before surgery. The case group received 1.5 ml/kg crystalloid fluids (ringer) while they were fasting. If patients had cardiac heart failure or end-stage renal disease were excluded from the study.

The patients of the control group were fasting for 8 hours before surgery, according to the protocol of the hospital, and did not receive any intravenous fluid before surgery. Finally, the patients of both groups were followed up during and after surgery and compared considering intraoperative and post-operative complications.

All patients were completely justified about the study, and they submitted a letter of satisfaction for participating in the study. They were assured that their information will be kept confidentially, and their name and address will not be disclosed. There was not any extra intervention in this study, and the patients did not pay any extra costs.

All understudy data were analyzed using SPSS software (version 17, SPSS Inc., Chicago, IL, USA) and descriptive statistical methods [frequency, percentage, mean, and standard deviation (SD)]. Chi-square and Fischer's exact (if required) statistical tests were used to compare qualitative findings, and quantitative variables were compared using independent t-test. In this study, $P < 0.050$ was considered meaningful.

Results

In this study, 100 patients underwent lower limbs orthopedic surgery was classified in two groups. Age average of the patients of the intervention and control groups was 59.86 ± 18.46 and 63.00 ± 15.92 years, respectively. Statistically, there was not any significant difference between two groups

(P = 0.360). The intervention group was consisted of 33 male (66%) and 17 female (34%) patients. There were 35 (70%) male and 15 (30%) female patients in the control group. There was not any significant difference between two groups considering gender (P = 0.660). Table 1 compares intraoperative and other complications after surgery. According to table 1, mortality rate and needs to ICU care were compared. Hemodynamic disorders and hypotension in the intervention group were significantly less than that of the control one and 6 patients (12%) of the intervention, and 30 patients (60%) of the control group required blood transfusion (cell pack). As observed, need to blood transfusion in the intervention group was significantly less than the control one (P < 0.001). In addition, mean transfused blood was not statistically meaningful in the groups. There was higher mean urine volume in the pre-operative fluid therapy group. Furthermore, ICU admission in the intervention group was significantly less than that of the control group. There was no significant difference between the groups considering mortality rate.

Discussion

The pre-operative fluid prescription is required for surgical care. Severity of disease, extent and duration of surgery, accompanying diseases, quality of patients' body response to pain all affect the need to intraoperative and pre-operative hydration.[12-15] However, high and low fluid therapy is associated with some complications. Low fluid therapy may lead to organ insufficiency due to decrease of intravenous fluid and adversely affect the performance of the heart, lungs, digestive system, and kidneys. It even affects tissue oxygenation and wound healing.[9-11]

However, high fluid therapy leads to some complications such as pulmonary edema, post-operative coagulopathy, and even compartment abdominal syndrome.[14-16] In spite of emphasize on pre-operative fluid therapy, there are still challenges about the volume of the prescribed fluids.[17,18] In orthopedic surgeries, as one of the major surgeries, appropriate fluid therapy may be useful in achieving better post-operative results. According to recent observations and studies, it was assumed that restrictive pre-operative fluid therapy may be associated with satisfaction results. Therefore, the present study classified the patients underwent lower limbs orthopedic surgery in two intervention group (pre-operative fluid therapy, n = 50) and control group (no pre-operative fluid therapy, n = 50). According to this study, pre-operative fluid therapy is associated with better results during and after surgery. According to previous studies, pre-operative hydration with appropriate volume of fluids may lead to better results and less post-operative complications.[19,20]

The present study suggested that pre-operative hydration is associated with less hemodynamic disorder and hypotension as well as less pack cell during surgery. Contrary to findings of the above study, Abraham-Nordling et al.[21] observed that more vasopressors are used in the restrictive fluid therapy group due to hypotension.

Table 1. Comparing complications of pre-operative fluid therapy and control groups

Variable	Control group (n = 50)	Case group (n = 50)	P
Hypotension [n (%)]	5 (10)	19 (38)	0.010*
Hemodynamic disorder [n (%)]	4 (8)	15 (30)	0.020*
Need to blood transfusion after operation [n (%)]	6 (12)	30 (60)	0.001*
Volume of transfused blood (unit) (mean ± SD)	1.70 ± 0.73	1.50 ± 0.54	0.510
Urine volume (cc) (mean ± SD)	1047.68 ± 586.78	750.36 ± 437.25	0.005*
Need to ICU [n (%)]	6 (12)	15 (30)	0.020*
Duration of ICU admission (day) (mean ± SD)	3.50 ± 1.87	5.00 ± 2.07	0.140
Duration of hospitalization (day) (mean ± SD)	6.96 ± 1.78	8.96 ± 3.10	0.040*
Mortality [n (%)]	2 (4)	3 (6)	0.200

*Significant difference
ICU: Intensive care unit; SD: Standard deviation

Similarly, Osugi et al.[12] suggested that pre-operative fluid therapy and hydration did not affect hypotension during surgery. The difference may be attributed to the type of surgery and the operated organ affecting need to hydration and its treatment outcomes. In addition, according to this study, there was not any difference in the mortality rate of the intervention group. However, the groups were different considering morbidity, intensive care costs, and hospitalization duration. There was not observed any major post-operative complication in this study. Furthermore, intraoperative complications were significantly less in the restrictive pre-operative fluid therapy group.

In a meta-analysis study, Boland et al.[22] reported that restrictive fluid therapy does not affect post-operative complications. Contrary to the above findings, however, they observed that restrictive fluid therapy does not affect post-operative complications.[23] Several studies reported different results considering the mentioned complications. According to Brandstrup et al.,[24] there was significantly fewer complications in the patients received restrictive fluids in comparison with the group with the standard regime of intravenous fluids. Similar results were reported in the studies conducted by Abraham-Nordling et al.,[21] de Aguilar-Nascimento et al., [25] Kocian et al.,[26] and Weinberg et al.[27] However, Warrillow et al.[28] stated that pre-operative fluid therapy is associated with more complications (about 57%) in major surgeries of digestive system. Of course, it should be noted that accompanying background diseases, as well as type and location of surgery, may be involved in emerging of complications independent from fluid therapy.[28] According to the present study, patients with pre-operative hydration significantly required less ICU admission as well as shorter hospitalization duration.

Contradictory findings were reported by the previous studies in this regard. Similar to this study, de Aguilar-Nascimento et al.[25] suggested that restrictive fluid therapy protocol leads to shorter hospitalization period. According to Weinberg et al.,[27] restrictive fluid therapy is associated with shorter hospitalization period. Contrary to the above-mentioned findings, Abraham-Nordling et al.[21] stated that restrictive pre-operative fluid therapy does not affect shorter hospitalization period. According to the metal-analysis study conducted by Boland et al.,[22] restrictive fluid therapy does not lead to shorter hospitalization period. Furthermore, Kocian et al.[26] believe that restrictive fluid therapy does not affect hospitalization duration. In general, as mentioned above, type, extension, and duration of surgery, as well as the accompanying background diseases may lead to more need to fluids and affect the type of fluid therapy. Therefore, the differences found in results of several studies may be attributed to above reasons. Interestingly, pre-operative fluid therapy significantly affects lower limbs orthopedic surgery.

Conclusion

According to results of the present study, it can be concluded that pre-operative fluid therapy leads to better intraoperative conditions, less hypotension, and shorter hospitalization period.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

This study was financially supported by Tabriz University of Medical Sciences.

References

1. Doherty M, Buggy DJ. Intraoperative fluids: how much is too much? Br J Anaesth 2012; 109(1): 69-79. DOI: 10.1093/bja/aes171
2. Nisanevich V, Felsenstein I, Almogy G, Weissman C, Einav S, Matot I. Effect of intraoperative fluid management on outcome after intraabdominal surgery. Anesthesiology 2005; 103(1): 25-32. DOI: 10.1097/00000542-200507000-00008

3. Lindenblatt N, Park S, Alsfasser G, Gock M, Klar E. [Intraoperative fluid management in pancreatic resections--the surgeon's view]. Zentralbl Chir 2008; 133(2): 168-75. DOI: 10.1055/s-2008-1004745

4. Holte K, Klarskov B, Christensen DS, Lund C, Nielsen KG, Bie P, et al. Liberal versus restrictive fluid administration to improve recovery after laparoscopic cholecystectomy: a randomized, double-blind study. Annals of Surgery 2004; 240(5): 892-9. DOI: 10.1097/01.sla.0000143269.96649.3b.

5. Holte K, Kristensen BB, Valentiner L, Foss NB, Husted H, Kehlet H. Liberal versus restrictive fluid management in knee arthroplasty: a randomized, double-blind study. Anesth Analg 2007; 105(2): 465-74. DOI: 10.1213/01.ane.0000263268.08222.19

6. Chappell D, Jacob M, Hofmann-Kiefer K, Conzen P, Rehm M. A rational approach to perioperative fluid management. Anesthesiology 2008; 109(4): 723-40. DOI: 10.1097/ALN.0b013e3181863117

7. Chawla G, Drummond GB. Textbook coverage of a common topic: fluid management of patients after surgery. Med Educ 2008; 42(6): 613-8. DOI: 10.1111/j.1365-2923.2008.03009.x

8. Soni N. British consensus guidelines on intravenous fluid therapy for adult surgical patients (GIFTASUP): Cassandra's view. Anaesthesia 2009; 64(3): 235-8. DOI: 10.1111/j.1365-2044.2009.05886_1.x

9. Brandstrup B. Fluid therapy for the surgical patient. Best Pract Res Clin Anaesthesiol 2006; 20(2): 265-83. DOI: 10.1016/j.bpa.2005.10.007

10. Kheterpal S, Tremper KK, Englesbe MJ, O'Reilly M, Shanks AM, Fetterman DM, et al. Predictors of postoperative acute renal failure after noncardiac surgery in patients with previously normal renal function. Anesthesiology 2007; 107(6): 892-902. DOI: 10.1097/01.anes.0000290588.29668.38

11. Holte K, Kehlet H. Fluid therapy and surgical outcomes in elective surgery: a need for reassessment in fast-track surgery. J Am Coll Surg 2006; 202(6): 971-89. DOI: 10.1016/j.jamcollsurg.2006.01.003

12. Osugi T, Tatara T, Yada S, Tashiro C. Hydration status after overnight fasting as measured by urine osmolality does not alter the magnitude of hypotension during general anesthesia in low risk patients. Anesth Analg 2011; 112(6): 1307-13. DOI: 10.1213/ANE.0b013e3182114df4

13. Grocott MP, Mythen MG, Gan TJ. Perioperative fluid management and clinical outcomes in adults. Anesth Analg 2005; 100(4): 1093-106. DOI: 10.1213/01.ANE.0000148691.33690.AC

14. Chieveley-Williams S, Hamilton-Davies C. The role of the gut in major surgical postoperative morbidity. Int Anesthesiol Clin 1999; 37(2): 81-110.

15. Lowell JA, Schifferdecker C, Driscoll DF, Benotti PN, Bistrian BR. Postoperative fluid overload: not a benign problem. Crit Care Med 1990; 18(7): 728-33.

16. Jacob M, Chappell D, Conzen P, Finsterer U, Rehm M. Blood volume is normal after pre-operative overnight fasting. Acta Anaesthesiol Scand 2008; 52(4): 522-9. DOI: 10.1111/j.1399-6576.2008.01587.x

17. Brauer KI, Svensen C, Hahn RG, Traber LD, Prough DS. Volume kinetic analysis of the distribution of 0.9% saline in conscious versus isoflurane-anesthetized sheep. Anesthesiology 2002; 96(2): 442-9. DOI: 10.1097/00000542-200202000-00033

18. Connolly CM, Kramer GC, Hahn RG, Chaisson NF, Svensen CH, Kirschner RA, et al. Isoflurane but not mechanical ventilation promotes extravascular fluid accumulation during crystalloid volume loading. Anesthesiology 2003; 98(3): 670-81.

19. Yogendran S, Asokumar B, Cheng DC, Chung F. A prospective randomized double-blinded study of the effect of intravenous fluid therapy on adverse outcomes on outpatient surgery. Anesth Analg 1995; 80(4): 682-6. DOI: 10.1097/00000539-199504000-00006

20. Bennett J, McDonald T, Lieblich S, Piecuch J. Perioperative rehydration in ambulatory anesthesia for dentoalveolar surgery. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1999; 88(3): 279-84. DOI: 10.1016/S1079-2104(99)70028-4

21. Abraham-Nordling M, Hjern F, Pollack J, Prytz M, Borg T, Kressner U. Randomized clinical trial of fluid restriction in colorectal surgery. Br J Surg 2012; 99(2): 186-91. DOI: 10.1002/bjs.7702

22. Boland MR, Noorani A, Varty K, Coffey JC, Agha R, Walsh SR. Perioperative fluid restriction in major abdominal surgery: systematic review and meta-analysis of randomized, clinical trials. World J Surg 2013; 37(6): 1193-202. DOI: 10.1007/s00268-013-1987-8

23. Joshi GP. Intraoperative fluid restriction improves outcome after major elective gastrointestinal surgery. Anesth Analg 2005; 101(2): 601-5. DOI: 10.1213/01.ANE.0000159171.26521.31

24. Brandstrup B, Tonnesen H, Beier-Holgersen R, Hjortso E, Ording H, Lindorff-Larsen K, et al. Effects of intravenous fluid restriction on postoperative complications: comparison of two perioperative fluid regimens: a randomized assessor-blinded multicenter trial. Ann Surg 2003; 238(5): 641-8. DOI: 10.1097/01.sla.0000094387.50865.23

25. de Aguilar-Nascimento JE, Diniz BN, do Carmo AV, Silveira EA, Silva RM. Clinical benefits after the implementation of a protocol of restricted perioperative intravenous crystalloid fluids in major abdominal operations. World J Surg 2009; 33(5):

925-30. DOI: 10.1007/s00268-009-9944-2
26. Kocian P, Neumann J, Majtan P, Hoch J. Fluid therapy and surgical outcomes after low anterior resection. Rozhl Chir 2014; 93(9): 463-7. [In Czech].
27. Weinberg L, Wong D, Karalapillai D, Pearce B, Tan CO, Tay S, et al. The impact of fluid intervention on complications and length of hospital stay after pancreaticoduodenectomy (Whipple's procedure). BMC Anesthesiology 2014; 14(35): 2-8. DOI: 10.1186/1471-2253-14-35
28. Warrillow SJ, Weinberg L, Parker F, Calzavacca P, Licari E, Aly A, et al. Perioperative fluid prescription, complications and outcomes in major elective open gastrointestinal surgery. Anaesth Intensive Care 2010; 38(2): 259-65.