The Journal of Arthroplasty 35 (2020) 2892–2898

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Primary Hip

Are Routine Postoperative Laboratory Tests Necessary After Primary Total Hip Arthroplasty?

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ARTICLE INFO

Article history:
Received 2 January 2020
Received in revised form
26 April 2020
Accepted 29 April 2020
Available online 7 May 2020

Keywords:
enhanced recovery after surgery
anemia
hypoalbuminemia
laboratory test
transfusion
total hip arthroplasty

ABSTRACT

Background: Recently, the practice of ordering routine postoperative laboratory tests in primary total hip arthroplasty (THA) has been challenged. This study aimed to evaluate the utility of routine postoperative laboratory tests after primary elective THA in an Asian population and identify the risk factors associated with abnormal postoperative laboratory test–related intervention.

Methods: We retrospectively reviewed 395 consecutive patients who underwent primary elective THA at a single tertiary academic center. Patient clinical information and laboratory test results were collected for analysis.

Results: A total of 349 (88.4%) patients had abnormal postoperative laboratory test results; most patients had anemia and hypoalbuminemia. Twenty-seven (6.8%) patients received clinical intervention. Of the 307 (77.7%) patients with postoperative anemia, 7 patients received blood transfusion. Factors associated with transfusion were female gender, low body mass index, long operation time, and low preoperative hemoglobin levels. Of the 149 (37.7%) patients with postoperative hypoalbuminemia, 16 received albumin supplementation. Factors associated with albumin supplementation were female gender, long operation time, and low preoperative albumin levels. Although 36 patients had abnormal postoperative creatinine, only 1 patient required specialist consultation. For electrolyte abnormalities, hyponatremia was noted; however, no patient received sodium supplementation. Moreover, 14 patients developed hypokalemia, of which 6 required potassium supplementation; 163 patients had hypocalcemia, of which 2 received calcium supplementation.

Conclusion: Routine laboratory tests after primary elective THA are unnecessary for most of the patients in modern clinical practice. However, for those with identified risk factors, postoperative laboratory tests still should be performed.

Blood tests for patients after surgery have been established in routine clinical practice, especially after major orthopedic surgery [1,2]. In the traditional clinical decision, laboratory tests are essential diagnostic tools and central to the investigation and management of many acute or chronic conditions. Postoperative laboratory tests are ordered to prevent missing critical clinical details, potential serious complications, and even subsequent litigation [2]. However, with the introduction of enhanced recovery

The authors X.-D.W., Z.-L.Z., and P.-C.X. contributed equally to this work.

Funding/Support: This study was supported by the Special Fund for Local Scientific and Technological Development under the Guidance of the Central Government (grant no.: Z135050009017).

This study received no specific grant from any funding agency, commercial, or not-for-profit sectors.

Clinical Trial Registry number: ChiCTR1900020690.

No author associated with this paper has disclosed any potential or pertinent conflicts which may be perceived to have impending conflict with this work. For full disclosure statements refer to https://doi.org/10.1016/j.arth.2020.04.097.

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https://doi.org/10.1016/j.arth.2020.04.097

after surgery protocol to the field of joint arthroplasty, particularly the widespread use of tranexamic acid, total hip arthroplasty (THA) has achieved unprecedented improvements in both modern-day surgical techniques and perioperative care pathways [1,3–10]. Consequently, the necessity of routine postoperative laboratory tests for patients who had primary elective THA has been challenged [11–18]. A series of studies have explored the utility of routine postoperative laboratory tests after total joint arthroplasty (TJA) and concluded that routine postoperative laboratory tests are unnecessary for primary unilateral TJA and that only patients with specific risk factors should undergo postoperative laboratory tests [12,14–18].

Given the wide variations in medical conditions among patient populations in different regions worldwide and as the problem of undernutrition, such as anemia and hypoalbuminemia, among older people in Asia remains severe [18–21], re-evaluating the utility of routine postoperative blood tests after primary unilateral THA in an Asian population is warranted [18–21]. Thus, this study aimed to evaluate the necessity of routine postoperative laboratory tests after primary elective unilateral THA, determine the incidence of abnormal postoperative laboratory results, clarify the frequency of medical intervention directly related to the abnormal laboratory results, identify the risk factors associated with abnormal laboratory test–related intervention, and develop a simple and quick risk-scoring system for clinical decision making.

Materials and Methods

Study Design and Patients

This study, which is part of our project registered on the Chinese Clinical Trial Registry, is in line with the *Strengthening the Reporting of Observational Studies in Epidemiology* guidelines [22]. Ethical approval (institutional review board 2019-015) for this retrospective cohort study was obtained from the appropriate ethics committee and institutional review board. The study protocol has been published previously, and the first author takes responsibility for the integrity and accuracy of the reported data and the fidelity of the study to the protocol [1].

Briefly, this retrospective study was performed in a cohort of patients who underwent primary elective unilateral THA and received multimodal perioperative care pathways according to the enhanced recovery after surgery protocol from January 2016 to November 2018. Exclusion criteria were THA for hip fractures; simultaneous bilateral THA; hip resurfacing arthroplasty or hemiarthroplasty; THA revision; primary unilateral THA after bone tumor resection of the hip; a previous diagnosis of an inherited bleeding disorder; and recorded operative times >240 minutes or <20 minutes (to limit the influence of extreme outliers) [1].

Data Collection

The following data were obtained from the electronic medical record system: age, gender, body mass index (BMI), surgical indications, preoperative comorbidities (eg, anemia, hypoalbuminemia, and diabetes), American Society of Anesthesiologists Physical Status classification, operation time, intraoperative blood loss, tranexamic acid use, length of hospital stay, preoperative and postoperative laboratory results (complete blood count and comprehensive metabolic panel), and any medical intervention that is directly related to abnormal laboratory values. All data were stored with Microsoft Excel (Microsoft Corporation, Redmond, WA).

Study Outcomes

The normal reference ranges for laboratory values and theoretical thresholds for clinical intervention are listed in Table 1. Specifically, any medical and surgical treatments in direct response to abnormal postoperative laboratory values were defined as abnormal laboratory test–related intervention (eg, anemia requiring blood transfusion, albumin supplementation for hypoalbuminemia, electrolyte supplementation, consultation on a hospitalist service, or medication changes or discontinuation).

Perioperative Management

In patients with abnormal preoperative laboratory tests, aggressive interventions were not routinely performed before primary elective THA as most of the preoperative abnormalities did not meet the theoretical threshold values for clinical intervention. A restrictive transfusion strategy (hemoglobin [Hb] level <70 g/L or symptomatic anemia with an Hb level >70 g/L) was applied for allogeneic red blood cell transfusion. Patients with preoperative anemia normally received recombinant human erythropoietin and intravenous iron, unless they met the criteria for blood transfusion. Patients with preoperative hypoalbuminemia (30 $\leq$ serum albumin <35 g/L) typically received oral nutrition supplements to improve nutritional status as much as possible, unless they met the threshold for albumin supplementation (serum albumin <30 g/L). Moreover, most of the preoperative electrolyte abnormalities were mild or moderate depletion and usually corrected by food (eg, banana for hypokalemia) or tablet. However, these preoperative interventions are often qualitative and hard to control; thus, some preoperative abnormal laboratory results may have not been corrected by the conservative intervention.

In the intraoperative period, arterial blood samples were routinely collected and analyzed immediately primarily to determine the amounts of arterial gases. However, the anesthesiologists would also use the arterial blood gas tests to guide intraoperative fluid management and correct electrolyte disturbance.

Table 1
Reference Ranges for CBC and CMP and Corresponding Threshold Values for Clinical Intervention.

Blood Test	Component	Reference Range		Threshold Values for Clinical Intervention
		Male	Female	
CBC	Hb (g/L)	130-175	115-150	Hb level of <70 g/L or symptomatic anemia with a Hb level of >70 g/L
	Platelet count (10^9/L)	85-303	101-320	Platelet count <30 × 10^9/L or poor platelet function
CMP	Albumin (g/L)	40-55	40-55	Albumin level <30 g/L
	Creatinine (μmol/L)	57-97	41-81	Increase in baseline creatinine ≥26.5 μmol/L
	Na (mmol/L)	137-147	137-147	Na level <137 mmol/L
	K (mmol/L)	3.5-5.3	3.5-5.3	K level <3.5 mmol/L
	Ca (mmol/L)	2.11-2.52	2.11-2.52	Ca level <2.0 mmol/L or if patients are symptomatic

CBC, complete blood count; CMP, comprehensive metabolic panel; Hb, hemoglobin; Na, sodium; K, potassium; Ca, calcium.

Table 2
Baseline Characteristics of the Study Cohorts.

Variables	Total	Normal Postoperative Laboratory Test	Abnormal Postoperative Laboratory Test	*P*
N (%)	395 (100)	46 (11.6)	349 (88.4)	
Preoperative variables				
Age (y)	58.2 ± 13.1	52.0 ± 16.0	59.1 ± 12.4	.006
Gender	203 F:192 M	17 F:29 M	186 F:163 M	.042
BMI (kg/m^2)	24.0 ± 3.6	25.2 ± 3.5	23.8 ± 3.6	.017
ASA score	2.2 ± 0.6	2.1 ± 0.7	2.2 ± 0.6	.676
Diabetes	37	4	33	>.999
Hb level (g/L)	129.0 ± 16.3	145.5 ± 12.9	126.8 ± 15.5	<.001
Albumin level (g/L)	41.4 ± 3.9	42.4 ± 2.9	41.2 ± 4.0	.046
Preoperative LOS (d)	4.8 ± 2.3	4.9 ± 2.3	4.7 ± 1.9	.589
Intraoperative variables				
TXA use	358	41	317	.787
Estimated blood loss (mL)	110.5 ± 86.3	81.1 ± 48.5	114.4 ± 89.5	<.001
Operation time (min)	64.8 ± 30.0	54.1 ± 16.2	66.2 ± 31.0	<.001
Postoperative variables				
Drop in Hb (g/L)	17.4 ± 10.3	13.6 ± 7.3	17.9 ± 10.5	.007
Drop in albumin (g/L)	5.9 ± 3.8	4.0 ± 2.6	6.2 ± 3.8	<.001
Drop in creatinine (μmol/L)	1.1 ± 19.5	2.6 ± 6.7	0.9 ± 20.6	.582
Drop in Na (mmol/L)	2.2 ± 2.6	1.8 ± 2.2	2.2 ± 2.7	.320
Drop in K (mmol/L)	−0.06 ± 0.40	−0.06 ± 0.32	−0.07 ± 0.41	.925
Drop in Ca (mmol/L)	0.17 ± 0.14	0.11 ± 0.09	0.18 ± 0.14	<.001
Postoperative LOS (d)	6.4 ± 2.7	6.4 ± 2.7	6.7 ± 2.6	.481

N, number; F, female; M, male; BMI, body mass index; ASA, American Society of Anesthesiologists Physical classification system; Hb, hemoglobin; LOS, length of stay; TXA, tranexamic acid; Na, sodium; K, potassium; Ca, calcium.

Statistical Analysis

Frequency (percentage) was calculated for qualitative data, and mean ± standard deviation or median (interquartile range) was calculated for quantitative data. An independent *t* test or Wilcoxon rank sum test was used to examine the difference in continuous variables between groups, whereas the chi-square test or Fisher exact test was used to compare the difference in categorical

Table 3
The Comparison of Variables Between Patients With Abnormal Postoperative Laboratory Tests and With or Without Intervention.

Variables	Abnormal Postoperative Laboratory Test Without Intervention	Abnormal Postoperative Laboratory Test With Intervention	*P*
N (%)	322	27	
Preoperative variables			
Age (y)	58.9 ± 12.5	61.9 ± 12.7	.227
Gender	163 F:159 M	23 F:4 M	.001
BMI (kg/m^2)	23.9 ± 3.5	22.1 ± 3.3	.014
ASA score	2.2 ± 0.6	2.2 ± 0.6	.641
Diabetes	30	3	.731
Anemia	90	14	.009
Hb level (g/L)	128.0 ± 14.4	113.0 ± 20.7	.001
Hypoalbuminemia	4	5	<.001
Albumin level (g/L)	41.4 ± 4.0	38.3 ± 3.7	<.001
Abnormal creatinine	30	2	>.999
Creatinine level (μmol/L)	71.0 ± 23.6	61.2 ± 26.4	.063
Abnormal Na	9	0	>.999
Na level (mmol/L)	142.9 ± 2.2	142.6 ± 2.8	.470
Abnormal K	9	9	<.001
K level (mmol/L)	4.1 ± 0.3	3.7 ± 0.5	.002
Abnormal Ca	19	7	<.001
Ca level (mmol/L)	2.29 ± 0.11	2.29 ± 0.31	.947
Preoperative LOS (d)	4.8 ± 2.3	5.1 ± 2.0	.536
Intraoperative variables			
TXA use	291	26	.306
Estimated blood loss (mL)	106.7 ± 75.2	201.9 ± 170.7	.008
Operation time (min)	65.1 ± 30.0	79.9 ± 40.1	.017
Postoperative variables			
Drop in Hb (g/L)	17.7 ± 9.8	19.8 ± 16.9	.524
Drop in albumin (g/L)	6.0 ± 3.7	7.9 ± 4.6	.011
Drop in creatinine (μmol/L)	1.12 ± 21.31	−2.74 ± 7.75	.351
Drop in Na (mmol/L)	2.3 ± 2.7	1.4 ± 3.0	.102
Drop in K (mmol/L)	−0.06 ± 0.38	−0.21 ± 0.59	.176
Drop in Ca (mmol/L)	0.17 ± 0.12	0.23 ± 0.25	.216
Postoperative LOS (d)	6.2 ± 2.7	8.0 ± 2.7	.001

N, number; F, female; M, male; BMI, body mass index; ASA, American Society of Anesthesiologists Physical classification system; Hb, hemoglobin; Na, sodium; K, potassium; Ca, calcium; LOS, length of stay; TXA, tranexamic acid.

Table 4
Abnormal Preoperative Laboratory Tests in Different Patient Groups.

Preoperative Item	Total ($n = 395$) (%)	Normal Postoperative Laboratory Test Group ($n = 46$)	Abnormal Postoperative Laboratory Test Group ($n = 349$)	Abnormal Preoperative Laboratory Test Without Intervention Group ($n = 322$)	Abnormal Postoperative Laboratory Test With Intervention Group ($n = 27$)
Diabetes	37 (9.4)	4	33	30	3
Anemia	104 (26.3)	0	104	90	14
Hypoalbuminemia	9 (2.3)	0	9	4	5
Abnormal creatinine	34 (8.6)	2	32	30	2
Abnormal Na	10 (2.5)	1	9	9	0
Abnormal K	18 (4.6)	0	18	9	9
Abnormal Ca	28 (7.1)	2	26	19	7

Na, sodium; K, potassium; Ca, calcium.

variables. A 2-tailed P value < .05 was considered statistically significant. All statistical analyses were performed with SPSS, version 21.0, software (SPSS Inc, Chicago, IL).

Results

Patient Characteristics

A total of 690 patients were screened for potential eligibility, and 395 patients were finally included for analysis (203 [51.4%] were females and 192 [48.6%] were males). Table 2 outlines the demographic characteristics of the included patients. Of note, the prevalences of preoperative anemia and hypoalbuminemia were 26.3% (104 of 395) and 2.3% (9 of 395), respectively (Tables 3 and 4). A total of 349 (88.4%) patients had abnormal postoperative laboratory results, which were mostly anemia (307 of 395; 77.7%) and hypoalbuminemia (149 of 395; 37.7%); 27 (6.8%) patients received clinical intervention (Table 5).

Of the 307 patients with postoperative anemia, 7 required blood transfusion. As the rates of blood transfusion were extremely low, logistic regression analysis could not be performed to identify the risk factors for transfusion. All 7 patients who received blood transfusion were females, had low BMI, experienced long operation time, or had low baseline Hb levels.

Of the 149 patients with postoperative hypoalbuminemia, 16 received albumin supplementation and were compared with those who did not require albumin supplementation. Univariate analysis showed significant differences in gender, operation time, and preoperative albumin level. Multivariate logistic regression analysis was not performed because of the low rate of albumin supplementation.

Although 36 (9.1%) patients had abnormal postoperative creatinine levels, most of them were asymptomatic with no adverse events, and only 1 patient underwent clinical observation after consultation. Regarding electrolyte abnormalities, hyponatremia was observed; however, sodium (Na) supplementation was not needed. Mild hypokalemia (3.0-3.5 mmol/L) was found in 13 patients and moderate hypokalemia (2.5-3.0 mmol/L) in 1 patient; 6 patients required potassium (K) supplementation. Postoperative hypocalcemia was found in 163 (41.3%) patients; only 2 patients received postoperative calcium (Ca) supplementation. Because of the very low medical intervention rates for abnormal postoperative creatinine, Na, K, and Ca levels, logistic regression analysis could not be performed to identify the risk factors associated with these outcomes.

Based on the preoperative, intraoperative, and perioperative risk factors for blood transfusion and albumin supplementation, as well as the perioperative changes in Hb, albumin, and electrolyte levels, a risk-scoring system was developed to predict severe abnormality in postoperative laboratory test results that require clinical intervention and to assess the necessity of postoperative laboratory tests (Fig. 1).

Discussion

Main Findings

The main finding of our study is that up to 88.4% of patients had abnormal postoperative laboratory results, and 6.8% of patients received medical intervention that is directly related to the abnormal laboratory values, which indicated that routine postoperative laboratory tests are unnecessary for most patients. Anemia and hypoalbuminemia were the most frequent abnormalities and required medical interventions. The intervention rates for abnormal postoperative creatinine, Na, K, and Ca levels were extremely low.

Comparison With Previous Studies

Several studies have evaluated the value of postoperative laboratory tests after TJA [12,14–18]. Compared with the data in previous studies, the incidence of abnormal postoperative laboratory results in our center was extremely high, but the laboratory test–related intervention rates were similar. A comparison of the

Table 5
Abnormal Postoperative Laboratory Tests and Intervention Directly Related to Abnormal Laboratory Tests in the Study Cohorts.

Postoperative Laboratory Test ($n = 395$)	Abnormal Postoperative Laboratory Test ($n = 349$)	Abnormal Postoperative Laboratory Test Without Intervention ($n = 322$)	Abnormal Postoperative Laboratory Test With Intervention ($n = 27$)	Received Clinical Intervention
Anemia	307	282	25	7
Hypoalbuminemia	149	126	23	16
Abnormal creatinine	36	33	3	1
Abnormal Na	16	14	2	0
Abnormal K	14	8	6	6
Abnormal Ca	163	140	23	2

Na, sodium; K, potassium; Ca, calcium.

Blood test	Risk Factor		Criteria	Score	Decision
Complete blood count (CBC)	Preoperative	Hemoglobin level	Normal	0	<3 Not Necessary ≥3 Necessary
			Mild anemia	1	
			Moderate/Severe anemia	3	
		ASA score	<3	0	
			≥3	1	
	Intraoperative	Operation time	≤50 min	0	
			50~75 min	1	
			≥75 min	3	
	Perioperative	TXA use	Yes	0	
			No	1	

Blood test	Risk Factor		Criteria	Score	Decision
Comprehensive metabolic panel (CMP)	Preoperative	Albumin level	≥35 g/L	0	<3 Not Necessary ≥3 Necessary
			30~35 g/L	2	
			<30 g/L	3	
		Creatinine level	<177 μmol/L	0	
			≥177 μmol/L	3	
		Electrolyte level	Normal	0	
			Mild imbalance	2	
			Moderate/Severe imbalance	3	
		ASA score	<3	0	
			≥3	1	
	Intraoperative	Operation time	≤50 min	0	
			50~75 min	1	
			≥75 min	3	
	Perioperative	TXA use	Yes	0	
			No	1	

Fig. 1. Points-based risk-scoring system for clinical decision making about the necessity of postoperative laboratory tests. ASA, American Society of Anesthesiologists Physical classification system; TXA, tranexamic acid.

patient characteristics showed that our patient population has a higher prevalence of undernutrition, as represented by the lower BMI, and a higher proportion of preoperative anemia [14–18,23]. Our study found that risk factors for transfusion are female gender, low BMI, long operation time, and low preoperative Hb level, which is in accordance with previous studies (Table 6) [15–18]. However, the basic metabolic panel test, which does not include the albumin level, rather than the comprehensive metabolic panel test has been routinely ordered in other institutions. Hence, data on hypoalbuminemia in previous studies are scarce.

Clinical intervention in our study also differed from that in previous studies. In our center, the abnormal laboratory test–related intervention was found mostly for undernutrition (anemia and hypoalbuminemia), and the disposal rates of abnormal postoperative creatinine level and electrolyte disturbance were pretty low. By contrast, the incidence of electrolyte disturbance and related intervention rates were quite high in previous studies [12–18]. The discrepancy may reflect a difference in patient populations and may be primarily attributed to the implementation of different perioperative care pathways. In our operating room and postanesthesia care unit, at least 3 arterial blood gas analyses were performed, and anesthesiologists would use arterial blood gas results to guide specific treatment decisions for electrolyte disturbance, combined with postoperative fluid administration, which leads to a low electrolyte disturbance rate.

Implications for Clinical Practice

The practice of ordering a standard battery of postoperative laboratory tests without due regard to clinical indication for patients after primary THA has long been the norm [2]. Our study adds to the growing evidence that postoperative laboratory tests

Table 6
Comparison of Transfusion Rate and Risk Factors for Transfusion With Previous Studies.

Study	Type of Surgery	Transfusion Rate	Identified Risk Factors
Greco et al, 2019 [18]	THA	10/401 (2.5%)	Higher intraoperative blood loss, higher BMI, lower preoperative Hb, longer operative duration, and younger
Greco et al, 2019 [18]	TKA	2/731 (0.3%)	Higher intraoperative blood loss, lower BMI, lower preoperative Hb, longer operative duration, and older
Halawi et al, 2019 [15]	TKA	3/319 (1%)	ASA ≥3, did not receive TXA, higher intraoperative blood loss, and preoperative anemia
Halawi et al, 2019 [16]	THA	8/351 (2.3%)	ASA ≥3, did not receive TXA, higher intraoperative blood loss, and preoperative anemia
Howell et al, 2019 [17]	TKA	25/484 (5.2%)	Female, lack of intraoperative TXA, and preoperative anemia
Our study	THA	7/395 (1.8%)	Female, lower BMI, lower preoperative Hb, and longer operative duration

THA, total hip arthroplasty; BMI, body mass index; Hb, hemoglobin; TKA, total knee arthroplasty; ASA, American Society of Anesthesiologists Physical classification system; TXA, tranexamic acid.

are unnecessary in most patients after primary unilateral THA. However, for patients with identified risk factors, routine postoperative laboratory tests are still needed [11–18]. These findings indicate that with the technological advancement in THA and perioperative health care improvement, most postoperative blood tests are normal (negative); moreover, as most abnormalities are borderline and require no further treatment, same-day THA is feasible in selected patients [24]. In addition, predicting abnormal postoperative laboratory test results is an important clinical issue, as it not only facilitates the clinical decision on whether postoperative blood tests should be performed in the inpatient clinical setting but also helps in deciding whether patients in the outpatient clinical setting need to be admitted to the hospital for postoperative laboratory tests [25,26].

Furthermore, our study also highlighted the importance of the clinical pathway for elective THA, especially the preoperative management pathway. On the one hand, the correction of preoperative abnormalities in our institution is conventional and qualitative; hence, undernutrition (anemia and hypoalbuminemia) as well as other abnormalities, may have not been fully corrected preoperatively and thus may continue to be abnormal or even aggravate, thereby requiring clinical intervention after surgery. Therefore, for patients with moderate or severe abnormal laboratory tests before THA, aggressive preoperative management should be recommended to avoid postoperative abnormalities and related intervention [27,28]. If elective THA was arranged for patients with severe abnormalities, preoperative optimization should be started as early as when they are still waiting for hospitalization, or the surgery could be postponed until they have improved their situation. On the other hand, a general medical checklist should be introduced into our clinical practice to record patients' preoperative abnormal laboratory tests, risk factors, coexisting comorbidities, and other important information, which would be helpful for preoperative optimization and improvement of the perioperative care pathway [29,30].

Call for Future Studies

Given that the rate of same-day TJA is expected to increase in the near future [31,32], additional studies on healthcare quality assessment and improvement are still necessary. First, further studies are required to validate the risk-scoring system, which was designed to be aggressive to prevent missing any severe abnormality or even subsequent complications; moreover, the prediction accuracy of the points-based risk-scoring system warrants further validation. Second, future studies are needed to explore whether abnormal postoperative laboratory test results and related intervention could be substantially reduced after optimization of the clinical pathway for elective THA. Finally, considering the differences in clinical pathways and patient populations among different institutions, external validity and generalizability of our findings require further evaluation. Institution-specific preoperative and intraoperative risk factors for abnormal postoperative blood tests should be explored.

Limitations

This study has several limitations. First, this study used a retrospective study design and was performed in a single tertiary academic center. Second, heterogeneity in routine clinical practice exists, which is mainly because of the variability of practice guidelines followed by the surgeons in response to abnormal laboratory values. Moreover, patients who have abnormal values just beyond the normal range may not always require medical intervention. Finally, data obtained from the electronic medical record system, including cofactors (eg, metastatic disease, endocrinopathies, liver cirrhosis) and certain medications (eg, erythropoietin, hydrochlorothiazide, angiotensin-converting enzyme inhibitors) that affect electrolyte balance, were inadequate for further analysis.

Conclusions

In patients undergoing primary unilateral THA, most of the laboratory test results tend to be abnormal; however, most of the abnormalities are borderline and require no further clinical intervention. Female gender, low BMI, long operation time, and low preoperative Hb level were risk factors for patients requiring blood transfusion, and female gender, long operation time, and low preoperative albumin level were risk factors for patients requiring albumin supplementation. Our study provides clinical evidence that routine postoperative laboratory tests are not necessary for most patients in modern clinical practice, which established the feasibility of same-day THA in selected patients. Nevertheless, postoperative laboratory tests after THA are still needed in patients with specific risk factors.

Acknowledgments

The authors thank Prof Gui-Xing Qiu (from the Department of Orthopedic Surgery, Peking Union Medical College Hospital, Beijing, China) for his substantial contributions during the revision for both data interpretation and manuscript revises; they also thank Jia Chen, MD, PhD (from the Department of Nutrition, The First Affiliated Hospital of Chongqing Medical University, Chongqing, China) and Yuan-Ping Jiang, MSc (from the Department of Blood Transfusion, Yongchuan Hospital of Chongqing Medical University, Chongqing, China) for their substantial contribution to the interpretation of data.

Authors' contributions: X.-D.W.: Contributed substantially to conception and design, acquisition of data, analysis, and interpretation of data; drafted the article; gave final approval of the version to be published; agreed to act as a guarantor of the work. Z.-L.Z., P.-C.X., J.-C.L.:, and J.-W.W.: Contributed substantially to the acquisition and interpretation of data; revised it critically for valuable intellectual content; gave final approval of the version to be published; and agreed to act as a guarantor of the work. W.H.: Contributed substantially to conception and design, acquisition of data, analysis, and interpretation of data; revised it critically for valuable intellectual content; gave final approval of the version to be published; and agreed to act as a guarantor of the work.

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