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Research Article

**INFLUENCE OF TRANSFUSION OF BLOOD ON
FUNCTIONS OF KIDNEYS IN THE PATIENTS
UNDERGOING TOTAL KNEE ARTHROPLASTY**¹Muhammad Arsalan Ali, ²Dr Abdullah Sarwar, ³Dr Nida Pervaiz¹MBBS Rawalpindi Medical University and Allied Hospitals, Rawalpindi, Pakistan²Hameed Latif Hospital Lahore³Punjab Medical College Faisalabad

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Abstract:

Objective: Different research works have investigated the impacts of peri-surgical transfusion of blood on the functions of kidneys. In this current research work, we examined the perioperative transfusion of blood on the functions of kidneys in the patients who were undergoing Total Knee Arthroplasty.

Methodology: This study was retrospective research work conducted on 216 patients who had undergone total knee arthroplasty from March 2018 to December 2019. The division of the patients was carried out into 2 groups in accordance with the level of transfused blood utilized during surgical intervention. There were 72.70% (n: 157) patients in the Group-1 requiring the blood transfusion of < 3 units, whereas 27.30% (n: 59) patients were present in Group-2 needed 3 or more units of blood.

Results: We examined no statistical difference in the patients of both groups regarding HTN (Hypertension) before surgical intervention, DM (Diabetes Mellitus), failure of kidney, habits of cigarette smoking and disease of lungs ($P > 0.050$). Similarly, there were no significant differences associated to pulmonary or other abnormalities or mortality of the patients ($P > 0.050$). When the comparison of the groups was carried out, we found no statistical difference in the functions of kidneys or other systems of body ($P > 0.050$).

Conclusions: There is no negative impact of transfusion of blood on the postsurgical levels of BUN (Blood Urea Nitrogen) and creatinine, or GFR (Glomerular Filtration Rate) in total knee arthroplasty.

KEYWORDS: Total Knee Arthroplasty, Creatinine, Postsurgical, Intervention, Kidney, Transfusion, Blood, Blood Urea Nitrogen, Diabetes, Hypertension, Lungs.

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INTRODUCTION:

In United States of America, 3.90% of all transfusion of blood used during surgical interventions are during the knee arthroplasty [1,2]. This rise in the perioperative transfusion of blood has caused an increase in the rate of morbidity as well as mortality [1,3]. There can be development of the complication's peri-operatively in the patients having transfusions of blood, these complications can be hemolytic & allergic reactions in the duration of operation, acute lung damage associated with transfusion, circulatory overload linked with transfusion, infection and graft-versus host diseases [4,5]. There is a further complication related with the perioperative transfusion of blood mentioned in various research works, which is the dysfunction of kidneys [6-8]. During our research in this particular literature, we found many research works examining the influences of perioperative transfusions of blood. However, we did not find any research work in the field of orthopedic surgery that particularly noticed the impacts during surgery of total knee arthroplasty. Therefore, this research work was carried out with the aim to examine the impacts of perioperative transfusion of blood on the functions of kidneys in the patients undergoing total knee arthroplasty.

MATERIAL AND METHODS:

In this research work, we reviewed 216 patients who underwent total knee arthroplasty from March 2018 to December 2019 in Allied Hospital Rawalpindi retrospectively. Ethical committee of the hospital gave the permission to conduct this research work. We noted the information about the age of the patient, sex, habits of cigarette smoking, past history of Hypertension, Diabetes Mellitus, chronic lungs complications and CKD (Chronic Kidney Diseases). We also collected the information about the total stay in the hospital, anesthesia type, pre-surgical and post-surgical

levels of blood glucose, amount of the perioperative transfusion of blood, postsurgical pulmonary complications, other associated postsurgical complications and postsurgical rate of morbidity as well as mortality. We also noticed the pre-operative and post-operative levels of urea, AST (Aspartate Aminotransferase), creatinine, ALT (Alanine Aminotransferase) and GFR (Glomerular Filtration Rates). The calculation of the Glomerular Filtration Rate carried out with the utilization of the Modification of Diet in Renal Diseases (MDRD) formula.

There were 72.70% (n: 157) patients who obtained transfusion of blood less than 3 units and formed Group-1. Remaining 27.30% (n: 59) patients received transfusion of blood more than 3 units and formed Group-2. There was focus of the comparison of the patients of both groups mainly on the pre-operative and post-operative functions of kidneys. Levels of hematocrit of the patients getting the blood transfusion were under 24.0% and there was not any requirement of hemodialysis for any of these patients. Any patient present with the pre-operative level of creatinine of 2.0 mg /dl or higher were not included in this research work. SPSS V.20 was in use for the statistical analysis of the collected information with 95.0% CI (Confidence Interval). The categorization of the continuous variables was performed and the comparison of these variables was carried out in accordance with the Chi-square test and Fisher's exact test. We used the T-test for the comparison of different variable between groups. P values of less than 0.050 was set as significant level.

RESULTS:

We found no significant difference between the pre-operative data of the patients of both groups about sex, age, Hypertension, Diabetes Mellitus, chronic lung disease, CKD and habit of cigarette smoking ($P > 0.050$) (Table-1).

Table-I: Preoperative Patient Data

Preoperative Patient	Group-1 (n:157)	Group-2 (n:59)	p
Age	65± 8.114	66±8.239	0.524
Gender (Female)	133(84.7%)	52(88.1%)	0.523
Gender (Male)	24(15.3%)	7(11.9%)	0.523
Hypertension presence	86(54.8%)	35(59.3%)	0.549
Diabetes Mellitus presence	61(38.9%)	21(35.6%)	0.66
Chronic Obstructive Lung Disease	26(16.6%)	7(11.9%)	0.393
Chronic Kidney Failure	5(3.2%)	1(1.7%)	0.553
Smoking	36(22.9%)	10 (16.9%)	0.339
BUN	37.5±12.292	38.4±11.089	0.624
Creatinine	0.83±0.0203	0.83±0.198	0.983
AST	20.9±6.456	20.9±6.380	0.553
ALT	18.4±7.630	19±8.024	0.999
GFR	61.3±4.896	60.9±5.607	0.58

The pre-operative level of urea, serum creatinine, Glomerular Filtration Rate, AST, ALT was similar statistically in the patients of both groups ($P>0.050$) (Table-1). When we compared the total duration of stay of the patients of both groups, there was longer stay in hospital of the patients of Group-2 as compared to the patients of Group-1 ($P<0.050$). Since majority of the patients underwent elective surgery, there was much frequent use of SA (Spinal Anesthesia) in 92.10% patients. We found no significant difference between the patients of both groups about the application of the type of anesthesia ($P>0.050$) (Table-2). There was not much difference in the patients of both groups about the pre-operative and post-operative pulmonary complications or the rate of mortality ($P> 0.050$) (Table-2).

Table-II: Perioperative Patient Data

Perioperative Clinical Data	Group-1 (n:157)	Group-2 (n:59)	p
General anesthesia	11 (7%)	6 (10.2%)	0.442
Spinal anesthesia	146 (93%)	53 (89.8%)	0.442
Mortality	0	0	-
Postoperative pulmonary complication	0	0	-
Other postoperative complications	0	0	-
Duration of hospital stay	6±0.8	6.3±0.87	0.016

When the comparison of the patients of both groups was carried out, we found no statistically significant difference regarding post-surgical function of kidneys or the functions of other systems of body ($P>0.050$) (Table-3).

Table-III: Postoperative Blood Values

Postoperative Blood Values	Group-1 (n:157)	Group-2 (n:59)	p
BUN	30±9.990	32.7±10.653	0.086
Creatinine	0.72±0.165	0.72±0.204	0.827
AST	23.4±12.739	22.9±9.083	0.793
ALT	16.5±12.905	16.8±7.854	0.87
GFR	62.8±2.870	62.5±4.103	0.583

When we reviewed the changes in the parameters of blood of the patients of both groups before and after surgery, we were unable to find any statistically significant difference about the values of urea, creatinine, AST, ALT and GFR ($P> 0.050$) (Table-4).

Table-IV: Comparison of Preoperative and Postoperative Blood Values of Group 1 and 2.

Blood value	Group 1 n:157	p	Group 2 n:59	p
Preop BUN	37.56±12.292	<0.001	38.46±11.089	<0.001
Postop BUN	30.09±9.990		32.77±10.653	
Preop Creatinine	0.83±0.203	<0.001	0.83±0.198	<0.001
Postop Creatinine	0.72±0.165		0.72±0.204	
Preop GFR	61.39±4.896	<0.001	60.93±5.607	0.004
Postop GFR	62.81±2.870		62.54±0.534	
Preop AST	20.98±6.456	0.017	20.98±6.380	0.117
Postop AST	23.45±12.739		22.97±9.083	
Preop ALT	18.41±7.630	0.061	19.06±8.024	0.038
Postop ALT	16.57±12.905		16.86±7.854	

DISCUSSION:

As the amount of the orthopedic surgical methods increases, there is relevant increase in the prevalence of perioperative transfusion of blood. All the patients undergoing total knee arthroplasty commonly receive transfusions of blood. These blood transfusions have a financial burden on the health care facilities and many other research works have stated clinical complications associated

with the transfusion of blood [9,10]. Many orthopedic and post-surgical research works in various fields have stated many complications after surgery associated with transfusions of blood as hemolytic, acute lung injury associated with transfusion, allergic reactions, circulatory overload linked with blood transfusion, infection, graft versus host disease and mortality [11]. Whitlock EL discovered that in a large retrograde research

work on the patients undergoing variety of surgeries, peri-operativetransfusion of a one single unit of RBC (Red Blood Cells) has association with the enhanced risk if the peri-operative MI (Myocardial Infarction) and ischemic stroke [12]. Opposite to this research work, we observed no cardiac complication in this research work. Some research works have discovered the association between the transfusion of blood and infection risk after the application of total joint arthroplasty [13]. Friedman R examined whether allogeneic transfusion of blood rises the risk of after-surgical infection in comparison with the autologous transfusion of blood or without blood transfusion. The rate of incidence of infections were in the both group of patients were similar. The findings of their research work conclude that rate of any infection, lower or upper RTI (Respiratory Tract Infection) and infections of lung and infection of wound were significantly increased after elective total knee arthroplasty in the patients obtaining allogeneic transfusion of blood in comparison with the patients getting autologous transfusion of blood or patients without transfusion of blood [14]. In this current research work, we discovered no significant difference between the patients of both groups about the rate of infections in lungs. In accordance with the findings of research work conducted by Ponnusamy KE, the impacts of transfusion of blood in the orthopedic surgeryinclude allergic reactions in 21.0%, and acute lung injury associated with transfusion in 27.0% patients. Among the presented complications, most frequent reasons of the high rate of mortality were graft versus host disease 85.0% to 100.0%, circulatory overload associated with the transfusion2.0% to 15.0% and acute lung injury linked with transfusion in 5.0% to 10% patients. Moreover, some other research works have discovered that the transfusion of blood are the main cause of increased risk of the transmission of viral infections and immune-suppression [15]. The results of this current research works are not comparable with these findings available in literature.

Some research works examined the association between the peri-operative transfusion of blood and delirium in the patients of older age undergoing elective orthopedic surgical interventions. They discovered that transfusion of blood during these surgeries was independent risk factor for delirium after application of surgical method [16]. One other complication linked with the peri-operative transfusion of blood is the post-surgical deterioration in the function of kidneys. Cardiovascular surgery research reports are frequently referred to the literature of orthopedic field [17]. In one research work, author investigated the impacts of transfusion of blood in the coronary bypass surgery. KuduvalliM provided

a comparison of the patients with blood transfusion and patients without blood transfusions. They discovered high rate of kidney failure in the group of patients present with transfusion of blood. When investigating the post-surgical morbidity as well as mortality, the research work found the rate of dysfunction of kidneys in the patients of coronary bypass to be 2.60%. Whitson BA examined the complications after the transfusion of blood product. There was much difference in the acute renal failure in the patients receiving the transfusion of blood products [9]. In this research work, we found no statistical difference about the levels of Glomerular Filtration Rate, urea and creatinine. One other research work reviewed the association between the usage of the blood products and renal failure. In accordance with the findings of that research work, the rate of prevalence of renal failure in the groups of the patients receiving transfusion of blood was 8.0% as compared to the 1.80% in the patients without transfusion of blood [18].

Satoglu IS provided a comparison of two groups for the parameters of blood describing the after-surgical failure of kidneys and other system of body and he detected no significant difference statistically. In this research work, we assessed the Glomerular Filtration Rate for the function of kidneys with other related values. We found no statistically significant difference between the patients of both groups about the function of kidneys. This research work investigated the impacts of peri-operative transfusion of blood on the function of kidneys.

In the literature regarding cardiovascular surgical interventions, research works show that there is much adverse impact of the transfusion of blood on the functions of kidneys. However, there are only few researches, considering this very topic in the fiend of orthopedicsurgeries. In spite of the understanding that the negative impact of the transfusion of blood on the functions of kidneys in cardiovascular surgeries, this current research work displayed no adverse impact of the blood transfusion on the function of kidneys during total knee arthroplasty. There are some limitations of this research work as this research work was a retrospective study. The size of sample of this population was very small. There is need of more research works on large sample sizes with the involvement of more centers for the consolidation of the findings of this research work.

CONCLUSION:

There are evidences that the rate of complications after the surgery increases with the perioperative transfusion of blood. Still, conflicting to other surgical disciplines, this current research work did

not find any negative impact of the transfusion of blood on the functions of kidneys in total knee arthroplasty. There is requirement of more research works with large size of samples and with the examinations of more parameters to consolidate the findings of this research work.

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