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Review Article

Risk Factors for the Development of Postoperative Acute Kidney Injury in Patients Undergoing Joint Replacement Surgery: A Meta-Analysis

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ABSTRACT. A new-onset acute kidney injury (AKI) after arthroplasty impairs rehabilitation and outcome. A prior knowledge of risk factors contributes to a planned preventive management and prognostication. Although many studies have addressed the issue, our objective was to perform a meta-analysis to bring a consensus on the perioperative risk factors promoting AKI postoperatively. We conducted a systematic review and meta-analysis of observational studies reporting risk factors with odds of development of AKI according to the existing criteria after hip or knee replacement surgery. We searched the PubMed and Google Scholar databases for free English articles published until June 2018. Two authors independently screened the articles and extracted data. Discrepancies were resolved by consensus or consulting the third author. Methodological quality of the articles was assessed using the Newcastle-Ottawa Scale. A total of five studies were included in this meta-analysis. The following risk factors were found to contribute to new kidney injury: advanced age; male gender; preoperative liver, cardiac, or kidney diseases; presence of heart failure; American Society of Anesthesiologists grade ≥3; requirement of perioperative blood transfusion, revision arthroplasty, and knee arthroplasty; body mass index; and use of angiotensin-converting enzyme inhibitors. Diabetes, hypertension, duration of surgery, type of anesthesia, and preoperative serum creatinine were not found to be associated with renal injury. The key limitation was the availability of small number of studies. More longitudinal observational studies addressing the issue are the need of the hour, and, till then, a preventive strategy aimed at the identified risk factors should help.

Introduction

There have been enormous advancements in the surgical care of patients requiring total joint arthroplasty, progressing to an era of faster recovery, earlier mobilization, and shorter hospital stay.[1] At this juncture, complications such as new-onset kidney disease impair the recovery characteristics and affect the overall outcome significantly.[2] Although there have been multiple studies[3-10] conducted to predict and establish risk factors for the development of acute kidney injury (AKI) in this group of

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patients, literature lacks consensus due to non-availability of review article and meta-analysis on the matter.[2] This leads to a situation where no concrete evidence exists regarding the effective prognostication and preoperative optimization of such patients.

Hence, the present meta-analysis is being undertaken to analyze all the published articles in English to establish the perioperative risk factors for the development of AKI in the postoperative period in patients undergoing joint replacement surgery.

Methods

Eligibility criteria

All published English language studies involving the evaluation of perioperative risk factors for the development of AKI after elective hip or knee replacement surgery in adults were included. Case reports; correspondence; letter to the editor; articles lacking a validated or universally accepted definition for AKI such as Risk, Injury, Failure, Loss and End Stage Kidney Function,[11] Acute Kidney Injury Network, Kidney Disease Initiative and Global Outcome, and International Classification of Diseases classification; and studies with no comparison between those who developed AKI and those who did not and studies with missing odds ratio (OR) were excluded. Patients who were classified as at risk for renal impairment were not included so as to maintain uniformity and high specificity.

Research question

What are the perioperative factors which predict the development of postoperative AKI in patients undergoing lower limb joint replacement surgery?

Participants

Studies involving adult replacement surgery patients.

Intervention

Those undergoing either hip or knee replacement surgery.

Comparison and Outcome

It included development of AKI in the post-operative period as opposed to those who did not develop.

Search strategy

The explorative search was done from PubMed and Google Scholar for all the related manuscripts published in English only till June 2018 without any date restrictions. The keywords for search were “risk factors,” “renal impairment,” “total knee replacement,” “primary total knee replacement,” “hip replacement,” “joint replacement,” “knee arthroplasty,” “hip arthroplasty,” “renal failure,” and “acute kidney injury.” The available articles were further checked for their list of references for any missing manuscripts. The titles and abstracts were manually screened for assessing the suitability for inclusion. Both the authors (PBR and NS) did design the database search based on the MEDLINE search strategy.

Study records

The studies meeting the inclusion criteria will be selected for the analysis. Two reviewers (PBR and NS) independently extracted data from the eligible articles. Data from both reviewers were matched and compared. A subset of the data was verified for accuracy by an individual not involved in the data extraction process. In cases of error detection, the full database will be reviewed to ensure accuracy. The data in relation to the risk factors evaluated to promote AKI after joint replacement surgery in adults were collected.

Quality assessment of individual studies

Quality assessment of individual studies included for analysis was done by Newcastle Ottawa scale[12] where a study with score 7 or more was considered of good quality.

Data synthesis

An individual meta-analysis was carried out for each risk factor identified in at least two studies. Individual ORs and its 95% confidence interval (CI) for the development of renal injury from each study were included in the overall analysis and formation of forest plot. The OR was used as the primary unit of analysis to evaluate differences in effect size between the groups. Data for analysis were directly extracted from the text and tables in the article. Heterogeneity was assessed for all outcome measures using I^2 values, and accordingly either a fixed or a random effect model was used.

The study protocol was registered with the Prospero register bearing registration no. PROSPERO CRD42014010707.

Statistical Analysis

Statistical analyses were performed by Review Manager (version 5.3, Informer Technologies, Inc., 8 Copthall, City - Roseau, 00152, Country - Dominican Republic). OR and mean difference with CIs (95%) were calculated for dichotomous data and continuous data collected from eligible studies, respectively. Forest plots were created to show the pooled results. Heterogeneity among combined study results was assessed by Cochran's Q test and by the degree of inconsistency (I^2).[13] Heterogeneity would be considered statistically significant if the *P* value for Cochran's Q test was ≤0.1. As for I^2, high heterogeneity was defined as >70%, medium heterogeneity was defined as 50%–70%, and low heterogeneity was defined as 0%–50%.[14] Relevant data were quantitatively summarized when a factor was investigated in at least two studies. Depending on the heterogeneity, random-effects models or fixed-effect models were applied to give more conservative results. $P < 0.05$ was considered statistically significant.[15]

Results

To investigate the risk factors for the development of AKI and failure, a random-effect meta-analysis was employed because of anticipated variation in study populations, geography, and study design. As a rule, we only included risk factors that were investigated in at least two studies using multivariate design, and the definitions of the same risk factor should be similar across all the included studies.

Finally, 17 factors (mean age in years, male gender, preop liver disease, preop heart failure, hypertension, diabetes, preop kidney disease, preop cardiac disease, American Society of Anesthesiologists (ASA) grade ≥3, type of anesthesia, revision arthroplasty, blood transfusion, knee versus hip surgery, angiotensin-converting enzyme (ACE) inhibitors, body mass index (BMI), preop serum creatinine, and duration of surgery) met our criteria and were included in the meta-analysis.

General study characteristics

The general characteristics of the included studies are presented in Table 1. A total of 7,272,816 patients were included in all of these five studies. All of them were retrospective cohort studies with three studies from America[4,5,16] and one each from Finland[10] and Australia.[17] Effect size and other details of all the risk factors analyzed are depicted in Table 2.

Age in years

Data on age as a risk factor for AKI were pooled from five studies.[4,5,10,16,17] Because there was higher heterogeneity (I^2 = 83%; P = 0.00001), a random-effects model was applied for sensitivity analysis. The pooled data suggested that patients with higher age undergoing replacement surgery had more chances of developing renal impairment [OR: 4.81 (3.52, 6.09); P = 0.001] (Figure 1a). A sensitivity analysis was conducted by a fixed-effects model. The pooled OR was 0.70 (0.29, 1.71) (P = 0.43).

Male gender

Five studies reported on male gender.[4,5,10,16,17] Because there was less heterogeneity among the included studies (I^2 = 0%, P = 0.47), a fixed-effects model was applied. The overall risk ratio for males was 1.30 (1.29–1.31) for renal impairment, which means males were at higher risk of renal impairment. This difference was statistically significant with $P < 0.001$ (Figure 1b).

Table 1. Main characteristics of the included retrospective studies.

Authors	Year published	Study period	Sample size	Knee or hip or both	AKI incidence	No. of factors studied	Geographic region/ country	AKI definition	NOS
Jafari et al	2010	2000–2007	17,938	Both	0.55%	16	The USA	RIFLE	7
Jamsa et al	2017	2002–2011	18,575	Both	0.3%	18	Finland	RIFLE	8
Nadkarni et al	2016	2002–2012	7,235,251	Both	1.3%	15	The USA	ICD 9M	8
Kimmel et al	2014	2011–2013	425	Both	14.8%	22	Australia	RIFLE	7
Sehgal et al	2014	2008–2009	627	Both	21.9%	5	The USA	AKIN	8

AKI: Acute kidney injury, NOS: Newcastle-Ottawa Quality Assessment Scale, RIFLE: Risk, Injury, Failure, Loss and End Stage Kidney Function, AKIN: Acute Kidney Injury Network, ICD: International Classification of Diseases.

Table 2. Synthesized effect size of 17 risk factors for the development of renal injury in patients undergoing joint replacement surgery.

Risk factors	No. of studies	OR (95% CI)	*Z* value	*P* value
Mean age in years	5	4.81 (3.52–6.09)	7.32	<0.001*
Male gender	5	1.30 (1.29–1.31)	80.47	< 0.001*
Preoperative liver disease	2	30.87 (30.67–31.06)	1069.39	<0.001*
Preoperative heart failure	2	5.92 (5.82–6.02)	210.25	<0.001*
Hypertension	2	4.44 (0.53–36.87)	1.38	0.17
Diabetes	4	3.25 (0.58–18.34)	1.34	0.18
Preoperative kidney disease	2	9.43 (3.96–22.47)	5.07	<0.00001*
Preoperative cardiac disease	2	2.04 (1.95–2.62)	5.6	<0.00001*
ASA grade ≥3	2	1.55 (1.16–2.09)	2.93	0.003*
Type of anesthesia	3	1.21 (0.99–1.49)	1.85	0.06
Revision arthroplasty	2	1.49 (1.05–2.11)	2.25	0.02*
Blood transfusion	2	2.01 (1.99–2.02)	168.05	<0.00001*
Knee versus hip surgery	2	1.28 (1.06–1.54)	2.57	<0.01*
ACE inhibitors	2	1.36 (1.10–1.67)	2.91	0.004*
BMI	3	2.78 (0.09–5.47)	2.02	0.04*
Preoperative serum creatinine	3	26.54 (−3.69–56.78)	1.72	0.09
Duration of surgery	2	15.75 (−6.92–38.43)	1.36	0.17

OR: Odds ratio, CI: Confidence interval, ASA: American Society of Anesthesiologists, BMI: Body mass index, ACE: Angiotensin-converting enzyme, *P value ≤0.05 = significant.

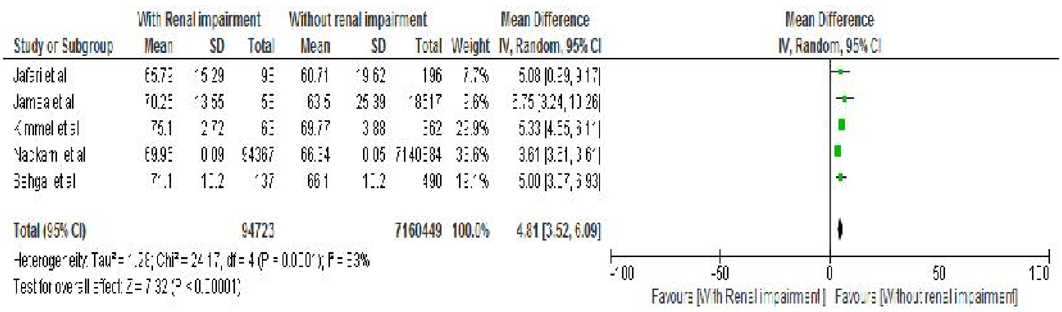

Figure 1. (a) Forest plot analysis with age as a risk factor for acute kidney injury.

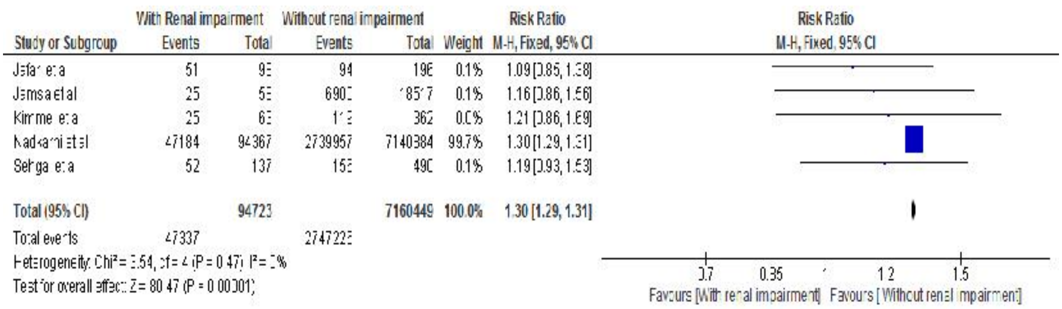

Figure 1. (b) Forest plot depicting male gender as a risk factor.

Preoperative liver disease

Only two studies[4,5] which compared the liver disease status among patients with or without renal impairment were included in this analysis. A fixed-effects model was used because of no heterogeneity (I^2 = 0%, P = 0.38). The overall risk ratio was 30.87 [(30.67, 31.06), P <0.001], which suggests that patients with liver disease are at higher risk of poor renal outcomes (Figure 1c).

Preoperative heart failure

Only two studies[4,5] which compared the heart failure status among patients with or without renal impairment were included in this analysis. A fixed-effects model was used because of moderate heterogeneity (I^2 = 25%, P = 0.25). The pooled results suggested that the presence of heart failure puts patients at higher risk for kidney injury [OR: 5.92 (5.82, 6.02); P <0.001] (Figure 1d).

Hypertension

Hypertension was evaluated as a risk factor for renal injury in two studies.[4,5] A random-effects model was used because of high heterogeneity

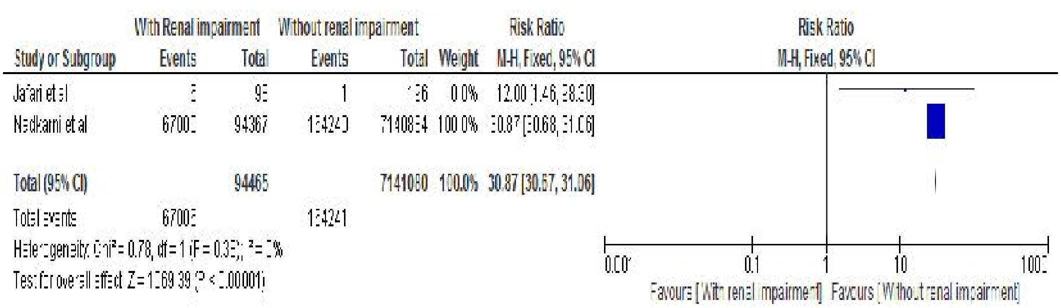

Figure 1. (c) Liver disease as a risk factor.

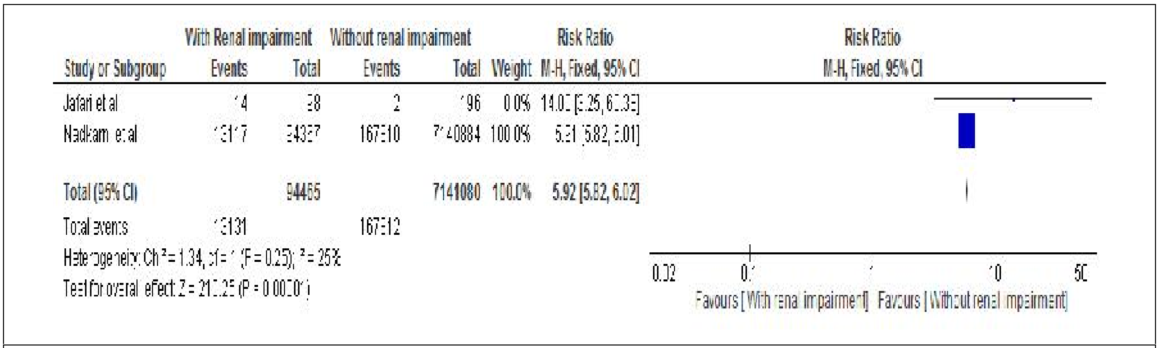

Figure 1. (d) Heart failure as a risk factor for postoperative renal impairment.

(I^2 = 100%, P = 0.00001) among the included studies. Although the overall risk of having renal impairment was 4.44 (95% CI: 0.53, 36.87) times higher in patients with hypertension, this increased risk was not statistically significant (P = 0.17) (Figure 1e).

Diabetes

Data on diabetes as one of the risk factors for renal impairment were obtained from four studies which compared the diabetes status among patients with or without renal impairment.[4,5,16,17] A random-effects model was used because of high heterogeneity (I^2 = 99%, P = 0.00001) among the included studies. Although the overall risk of having renal impairment was higher in patients with diabetes [OR 3.25 (0.58, 18.34)], this increased risk was not statistically significant (P = 0.18) (Figure 1f).

Preoperative kidney disease

Only two studies[4,5] which compared the preoperative renal status as a risk factor for renal dysfunction were included in the analysis. In

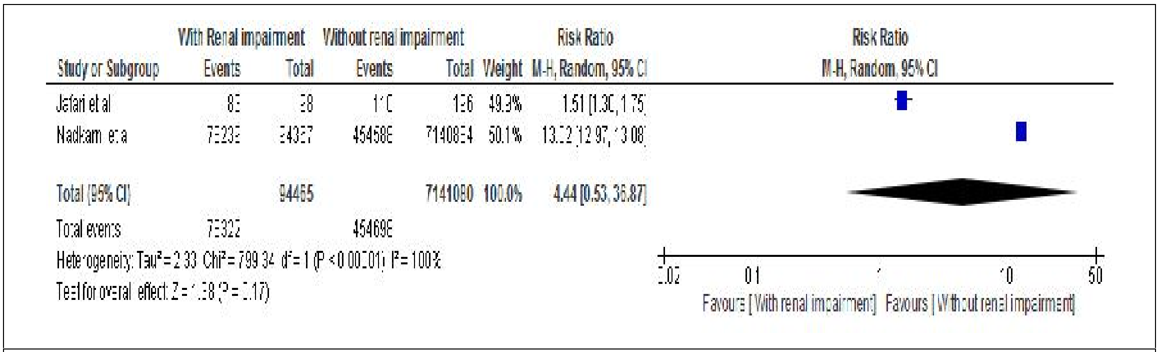

Figure 1. (e) Hypertension and postoperative renal injury.

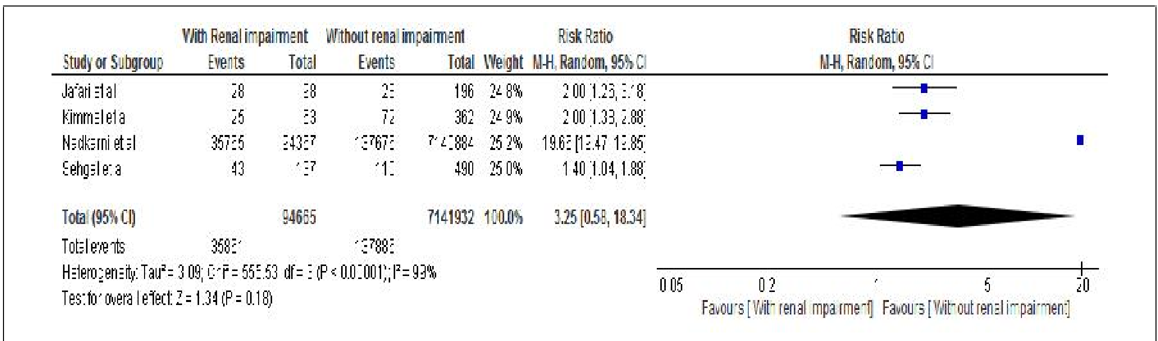

Figure 1. (f) Diabetes and risk of renal impairment.

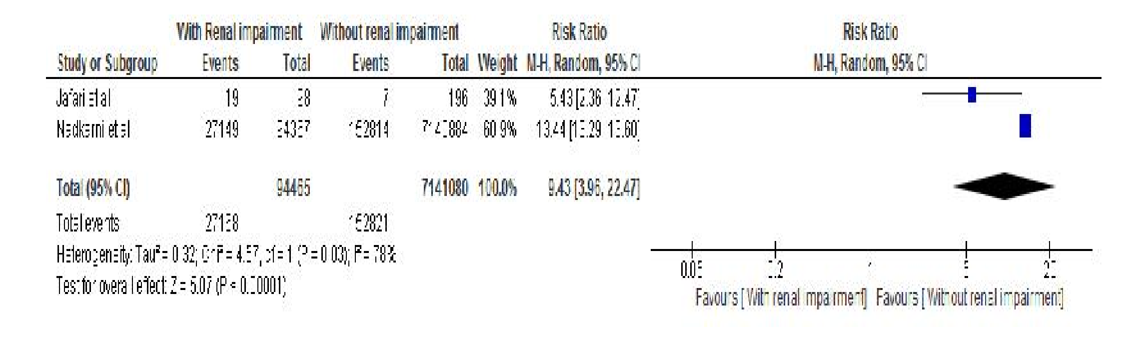

Figure 1. (g) Preoperative kidney disease and risk of acute kidney injury.

the study by Jafari et al,[4] 19 patients out of total 98 cases who developed renal dysfunction after surgery had preoperative renal disease, whereas only seven out of 196 controls had a kidney disease. Similarly, 2,170,575 patients had kidney disease at the preoperative period out of a total of 7,235,251 patients studied by Nadkarni et al. A random-effects model was used because of high heterogeneity (I^2 = 78%, P = 0.03) among the included studies. The overall risk of having renal impairment was considerably higher in patients with preoperative kidney disease with OR 9.43 (3.96, 22.47, P <0.00001) (Figure 1g).

Cardiac disease

Presence of cardiac disease and the risk of AKI were evaluated in two studies.[4,17] A fixed-effects model was used because of no heterogeneity (I^2 = 0%, P = 0.39) among the included studies. The pooled data suggested that the presence of cardiac disease in the patient undergoing knee or hip replacement surgery is associated with perioperative renal impairment with an OR of 2.04 (95% CI: 1.95–2.62, P <0.00001) (Figure 1h).

American Society of Anesthesiologists grading

Two studies which compared ASA grade among patients with or without renal impairment were included in this analysis.[4,10] One hundred and sixty-nine patients out of 294 total had ASA physical status of three or more in the study conducted by Jafari et al,[4] whereas Jämsä et al[10] conducted a study on 18,575 patients and observed only 47 of those who had postoperative AKI and 8491 in those who did not have AKI after surgery had ASA status 3 or more. A random-effects model was used because of higher heterogeneity (I^2 = 85%, P = 0.009) among the included studies. The overall risk of having renal impairment was 1.55 times higher in patients with higher ASA grade with 95% CI of 1.16–2.09 (P = 0.003) (Figure 1i).

Type of anesthesia

Three studies[4,10,17] discussed the effect of type of anesthesia on the development of

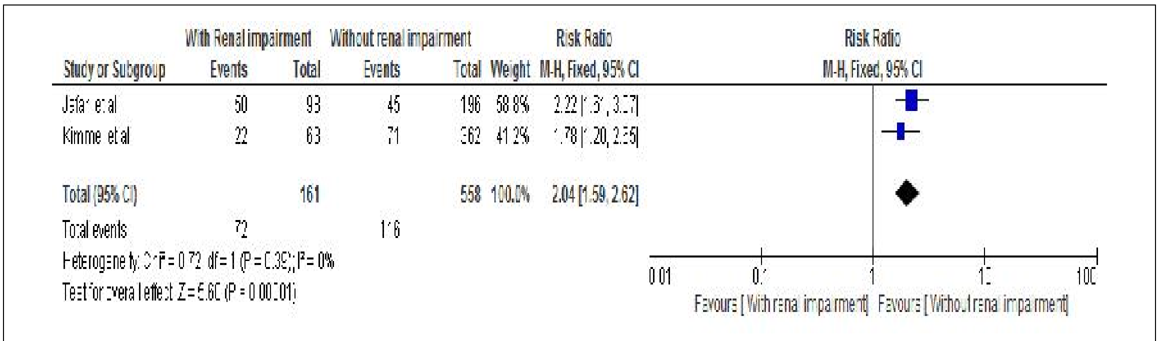

Figure 1. (h) Comparison of cardiac disease among patients with and without renal impairment.

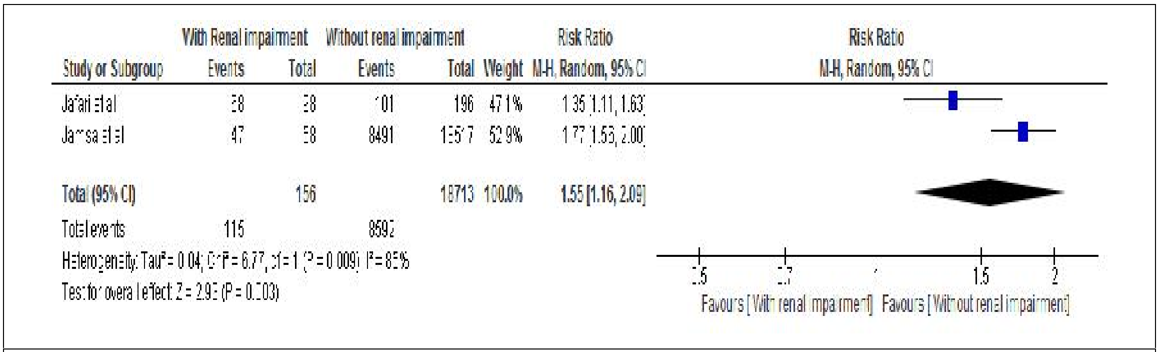

Figure 1. (i) Comparison of American Society of Anesthesiologists grade among patients with and without renal impairment.

postoperative renal impairment. A fixed-effects model was used because of moderate heterogeneity (I^2 = 40%, P = 0.19) among the included studies. Overall, the pooled data did not result in any increased risk of renal impairment in patients undergoing general as against regional anesthesia [OR: 1.22 (0.99–1.49), P = 0.06] (Figure 1j).

Revision surgery and acute kidney injury

Data on revision surgery as a risk factor were found in two studies.[4,10] A fixed-effects model was used because of moderate heterogeneity (I^2 = 85%, P = 0.45) among the included studies. The pooled results showed that the overall risk of having renal impairment was higher among patients underwent revision surgery with an OR of 1.49 (1.05–2.11, P = 0.02) (Figure 1k).

Blood transfusion

Two studies[5,17] discussed the role of blood

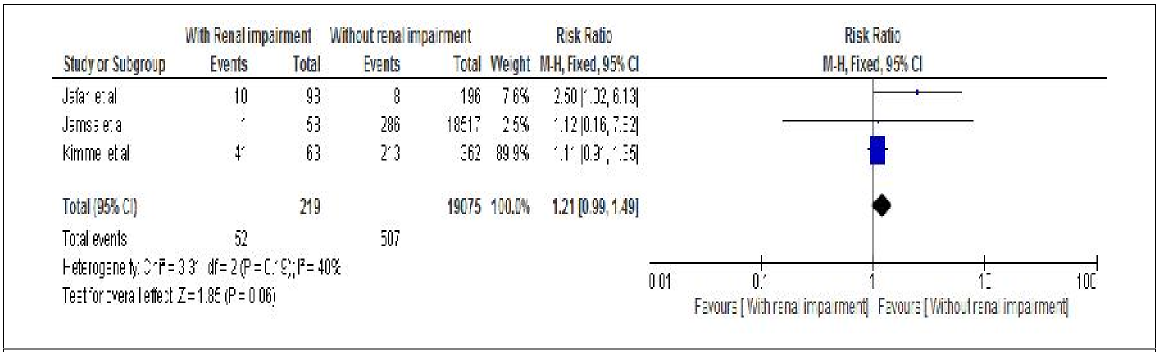

Figure 1. (j) Type of anesthesia and renal damage.

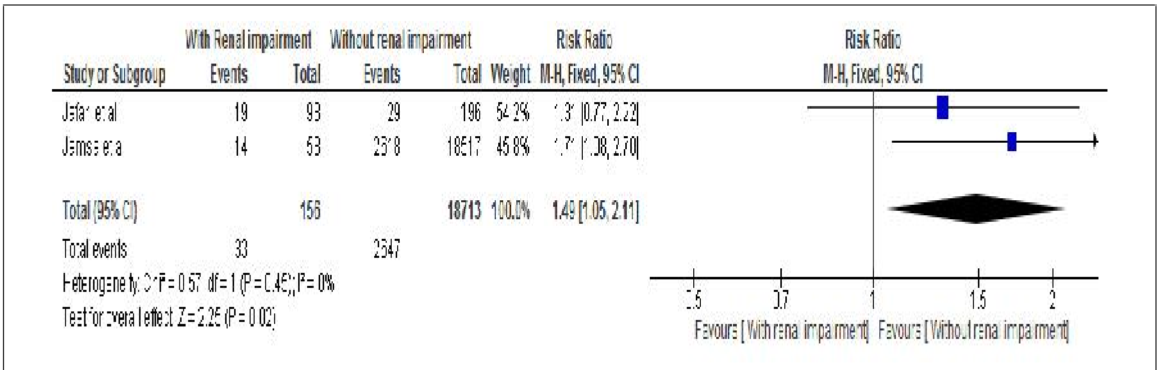

Figure 1. (k) Revision surgery as a risk factor for acute kidney injury.

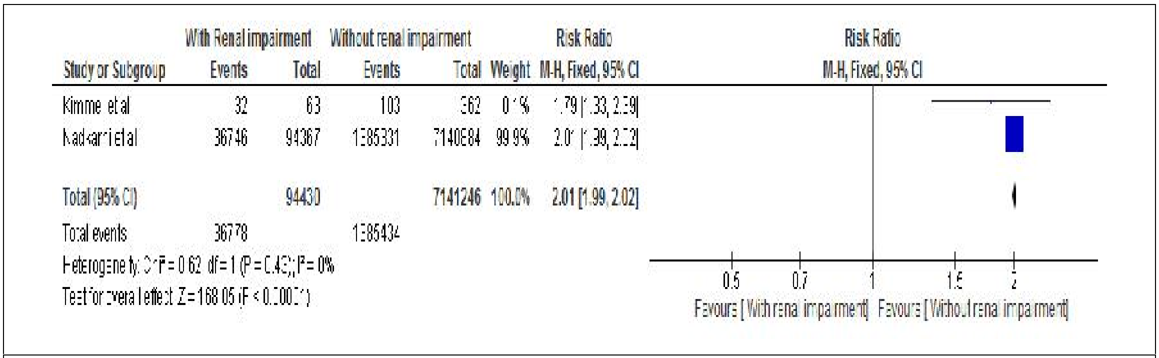

Figure 1. (l) Comparison of blood transfusion among patients with and without renal impairment.

transfusion on the chances of development of renal injury after arthroplasty. A fixed-effects model was used because of no heterogeneity (I^2 = 0%, P = 0.43) among the included studies. The pooled results demonstrated a significantly increased risk of renal impairment with an OR of 2.01 (95% CI of 1.99–2.02, P <0.00001) (Figure 1l).

Knee surgery against hip

Data from two studies[10,17] were extracted regarding knee surgery as a risk factor for renal impairment as against hip arthroplasty. A random-effects model was used because of fairly high heterogeneity (I^2 = 51%, P = 0.15) among the included studies. The overall risk of having renal impairment was 1.28 (95% CI of 1.06–1.54), and this difference was statistically significant (P <0.01) (Figure 1m).

Angiotensin-converting enzyme inhibitors

Data from two studies,[16,17] which compared the use of ACE inhibitors for renal impairment were included. A fixed-effects model was used because of no heterogeneity (I^2 = 51%, P = 0.68) among the included studies. The overall

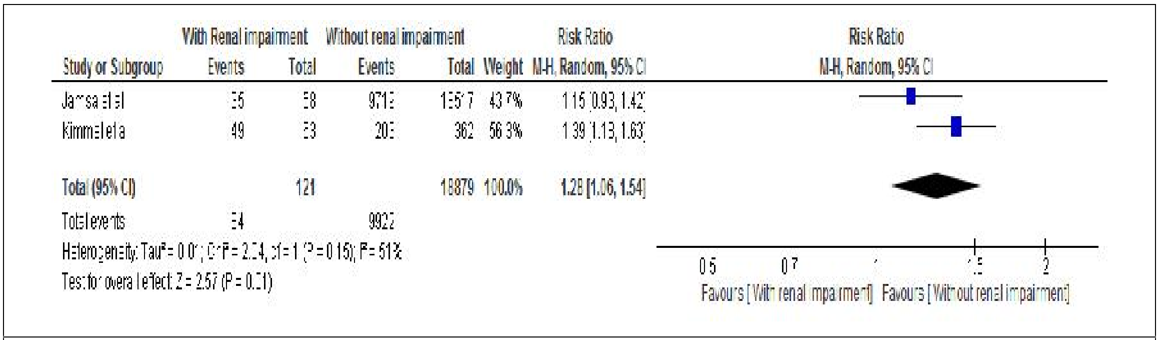

Figure 1. (m) Comparison of knee surgery among patients with and without renal impairment.

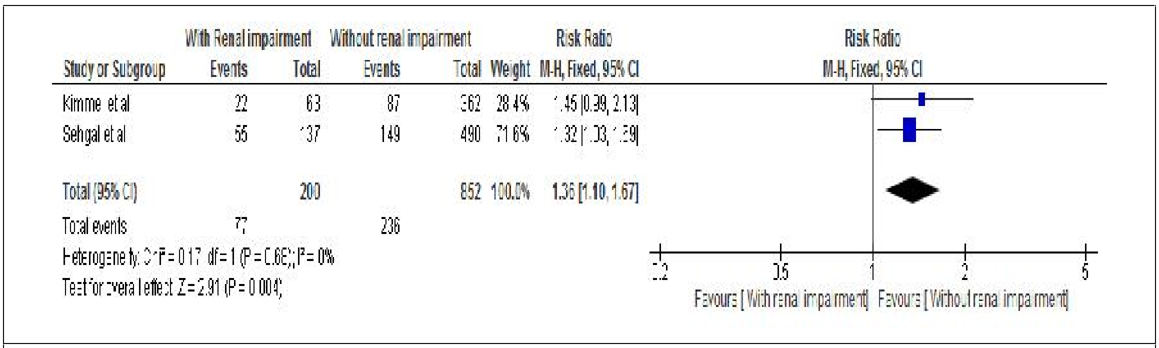

Figure 1. (n) Use of angiotensin-converting enzyme inhibitors and renal impairment.

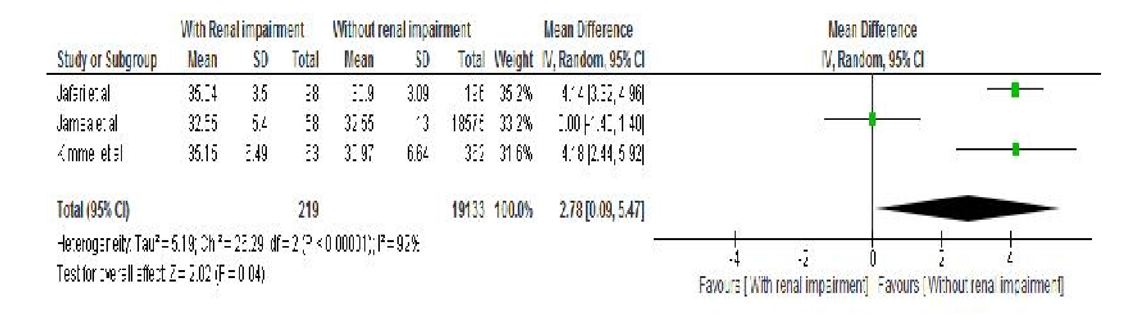

Figure 1. (o) Comparison of body mass index of patients with and without renal impairment.

risk of having renal impairment was found to be an OR of 1.36 (1.10–1.67, P = 0.004) (Figure 1n).

Body mass index

The mean difference of BMI (in kg/m^2) was compared in the meta-analysis, and three studies[4,10,17] were included for the purpose. Because there was higher heterogeneity (I^2 = 92%, P = 0.00001), we applied a random-effects model. Pooled results suggested that patients with lower BMI undergoing surgery had better outcome in terms of renal impairment with an OR of 2.78 (95% CI: 0.09–5.47, P = 0.04) (Figure 1o).

Preoperative serum creatinine

The mean differences of preoperative serum creatinine were compared in the meta-analysis, and three studies[4,10,17] were included for the purpose. Because there was higher heterogeneity (I^2 = 100%, P = 0.00001), we applied a random-effects model. Pooled data suggested that preoperative serum creatinine is not associated with a poor renal outcome with an OR of 26.54 (95% CI: −3.69–56.78, P = 0.09) (Figure 1p).

Duration of surgery

The mean difference in duration of surgery was compared in the meta-analysis, and two studies[4,17] were included for this purpose. Because there was higher heterogeneity (I^2 = 99%, P = 0.00001), we applied a random-effects model. Although the data showed that patients with shorter duration of surgery had better outcome in terms of renal impairment with an OR of 15.75 (−6.92, 38.43), it was not statistically significant (P = 0.17) (Figure 1q).

Discussion

This is a systematic review and meta-analysis assessing the risk factors for the development of acute renal injury in the postoperative period in patients undergoing lower limb joint arthroplasty. The pooled results indicate that advanced age; male gender; preoperative liver, cardiac, or kidney diseases; presence of heart failure; ASA grade ≥3; requirement of peri-

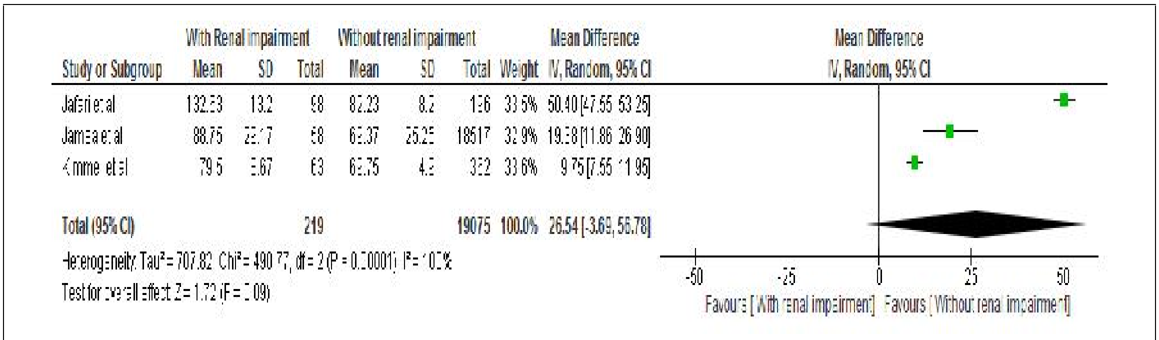

Figure 1. (p) Preoperative serum creatinine.

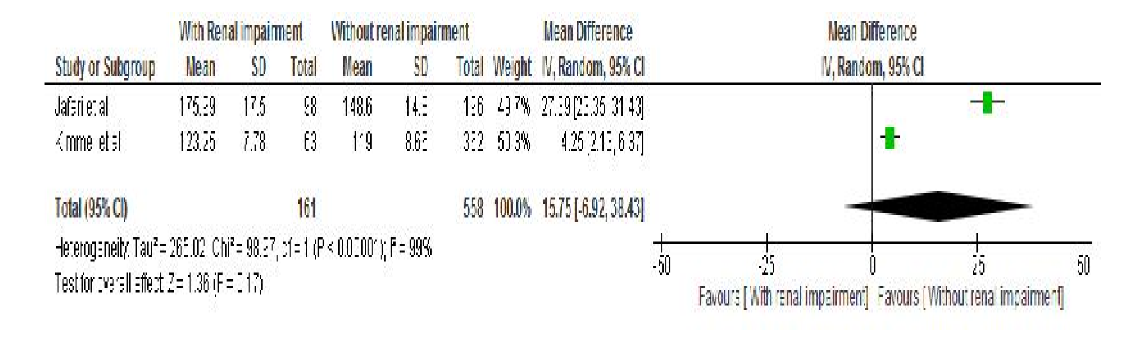

Figure 1. (q) Duration of surgery and risk of renal impairment.

operative blood transfusion; revision arthroplasty; knee surgery as against hip arthroplasty; BMI; and use of ACE inhibitors were found to be positively associated with a higher incidence of acute renal impairment. In contrast, factors such as presence of diabetes, hypertension, duration of surgery, type of anesthesia, and preoperative serum creatinine were not found to be associated with patients developing renal injury.

AKI is actually a spectrum encompassing renal impairment of all kinds and degrees developing over a period of hours to days.[18] The likelihood of insult to the kidneys is high in the perioperative period as these are the group of patients who are exposed to not only surgical but also a lot many medical factors together. The outcome of any surgery does not only rely on the surgical skill and expertise, but also depends a lot on avoiding all kinds of possible complications arising out of the surgery. It is a well-known fact that AKI potentiates the morbidity, mortality and hospital stay and invites other complications such as sepsis, anemia, and mechanical ventilation.[19-21] Further, it also opens up pathway for the future development of chronic kidney disease even after recovery of normal renal function.[22]

Hence, the rule of prevention is better than cure stands tall, and the efforts to predict the possible development of AKI are of utmost priority.[23]

Arthroplasty, either hip or knee, is usually an elective procedure and mostly rehabilitative in nature. Complications of any nature might hamper the recovery characteristics of these patients, resulting in a poor outcome. In addition, preventing AKI not only results in a significant savings for the patients as well as for the whole nation by reducing the number of hospital inpatient days, but also makes available of such limited resources to other patients in need.[24,25]

Therefore, it is important to identify the risk factors promoting AKI in the postoperative period. In this meta-analysis, we found that mean age, male gender; heart failure; preoperative liver, kidney, and cardiac diseases; higher BMI; use of ACE inhibitors; knee surgery; blood transfusion; revision arthroplasty; and higher ASA class are the factors which increase the chances of renal impairment after arthroplasty. In contrast, diabetes, hypertension, duration of sur-gery, and type of anesthesia provided were not found to enhance the risk of renal injury.

Aging is a normal process which affects the cell biology of all organ functions. It also brings in different hormonal changes and promotes atherosclerosis. This negatively affects renal vascular theology and contributes to renal aging.[26] We found that increasing age especially after the sixth decade of life enhances the risk of AKI after arthroplasty.

Either less or more, comorbidities always add to the poor outcome after surgery. As the number of these associated illness increases, the outcome worsens. Hence, it is essential to assess the premorbid status of all patients undergoing surgery in the preoperative period.[27] We observed preoperative liver, cardiac, and renal diseases promoting postoperative renal injury. It is a well-known fact that involvement of one organ leads to failure in another organ in the human body, which is called organ crosstalk.[28] Renal dysfunction is not uncommon after episodes of liver failure, decompensated heart failure, or in patients with preexisting renal disease. A multitude of mechanisms have been proposed for the deterioration of renal function such as hemodynamic, neurohumoral, and demographic changes and medical interventions.[29] Medical interventions such as the use of ACE inhibitors and blood transfusion in itself are known to cause increased renal morbidity. ACE inhibitors are a group of antihypertensives known to cause renal impairment to the extent that ACE inhibitor-induced renal failure has been now established as a separate entity. However, it always leads to renal damage in the setting of preexistent reduction in renal perfusion, which is very common during arthroplasty surgery. This may result from distorted autoregulation due to anesthesia-induced hypotension, bone cement syndrome, blood loss during surgery, or surgical position related alteration in perfusion, etc. This is further known to add to the development of renal atrophy on a long term.[30]

Surprisingly, factors such as diabetes, hypertension, preoperative serum creatinine, type of anesthesia (general vs. spinal), and duration of surgery were not found to be associated with an increased risk of renal impairment after arthroplasty. The current evidence suggests that the choice of anesthesia has a great impact on the perioperative outcome, hence it must be considered to be playing a role of an important factor. Although the evidence is conflicting regarding the choice of general over regional anesthesia, it is repeatedly found that regional anesthesia has a number of advantages such as reduced mortality, thromboembolic events, blood loss, and transfusion requirements. Our meta-analysis did not result in an increased risk of renal injury. Therefore, till further data and clarification comes, it is prudent to consider that regional anesthesia stands equal to general anesthesia at least with regard to the risk of renal impairment.[31]

Both diabetes and hypertension are known factors promoting a range of alterations in the normal kidney physiology and function, leading to renal damage.[32,33] The results in this meta-analysis in fact found these two factors to be enhancing the risk of renal injury by 3 to 4 folds, but *P* value was not statistically significant. This probably reflects a lesser-than-required sample size in the relevant studies analyzed rather than anything else.

The present study has some strengths as well as limitations. One of the strengths is the presence of low statistical heterogeneity in the combined results except for a few factors. In addition, random-effects models were applied in this meta-analysis to acquire more conservative results as and when required. Second, we were able to address the role of a multitude of factors in finding the association with acute renal injury.

This study also has several limitations. First of all, the summarized results are based on only five or fewer studies and all of those are retrospective in nature. Although randomized controlled trial is the most preferred study design, there are some areas in clinical research where these are not possible. Hence, retrospective study design stands good while assessing for the risk factors for a given clinical situation. Second, all the studies did not address all the factors analyzed. Third, as per the study protocol, we analyzed a factor if at least two studies have addressed it. Therefore, many factors remained unattended because of mention in only one of the studies. Fourth, some potentially eligible studies could not be included due to lack of a common definition of AKI and the way of statistical expression was different.

In addition, even the enrolled studies had limitations. All of those[4,10,16,17] were based on single institution except one.[17] Further, due to the low incidence of AKI, the number of patients in the study group was relatively small, which makes the comparability between the study and control groups weak.

As the number of studies under evaluation was less than ten, assessment of publication bias utilizing funnel plot was omitted.[34]

Conclusions

This meta-analysis provided comprehensive evidence that advanced age; male gender; presence of liver, cardiac, and preexisting renal disease; heart failure; use of ACE inhibitors; blood transfusion; BMI; knee surgery; revision surgery; and ASA class >3 could increase the risk of development of AKI in patients undergoing lower limb arthroplasty. Early detection of the risk factors helps in the formation of preventing strategies, which might mitigate the development of AKI. Because of the limitations in the present meta-analysis and available literatures, further research, especially well designed with larger sample size, is warranted on the topic to have a better understanding.

Conflict of interest: None declared.

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