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Patient Experience and Acceptance of Telenephrology for Kidney Transplant Follow-Up: Experience From a Public Sector Tertiary Care Hospital in India

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Abstract

Background: Kidney transplant recipients (KTRs) require frequent long-term monitoring, which can pose major geographic and economic challenges, particularly in public sector healthcare settings. We evaluated patient experience, perceived benefits, and barriers to telenephrology introduced during the COVID-19 pandemic at a tertiary referral center in India.

Methods: This cross-sectional study included 100 KTRs selected by systematic sampling from recipients who had used telenephrology services between April and September 2020 at the All India Institute of Medical Sciences (AIIMS), New Delhi. A structured questionnaire assessing demographics, travel-related burden, direct and indirect costs of in-person consultations, and patient experience using a 5-point Likert scale was administered by telephone in the local language.

Results: The mean patient age was 32.83 ± 9.96 years, and 92 (92%) were male. The median one-way distance to the hospital was 304.5 km (range: 6-1673 km), and 87 (87%) relied on public transport. Physical visits incurred a median cost of INR 3000 (range: INR 40-15,000); 57 (57%) participants reported productivity loss, and 47 (47%) stayed for four or more days near the hospital. During remote follow-up, 98 (98%) were confident expressing their concerns by telephone, and 99 (99%) rated their telenephrology experience 4 or 5 on a 5-point scale. The main perceived benefit was saving on travel, accommodation, and lost work time, reported by 79 (79%), while the most common limitation was the lack of physical presence of the doctor, reported by 22 (22%) participants. Following resumption of routine services, 97 (97%) participants preferred a combination of remote and in-person consultations.

Conclusions: Telenephrology was well accepted by kidney transplant recipients who had used the service and was perceived to reduce the financial and logistical burden of transplant follow-up. Most participants nevertheless preferred a combination of remote and in-person consultations. These findings support telenephrology as an adjunct to, rather than a replacement for, in-person transplant care.

Categories: Nephrology, Healthcare Technology
Keywords: healthcare access, hybrid care, kidney transplantation, patient satisfaction, public sector healthcare, telemedicine, telenephrology

Introduction

Kidney transplantation is currently the best form of renal replacement therapy for end-stage kidney disease (ESKD). By 2030, the prevalence of ESKD is expected to increase by 29%-68% in the United States [1]. The prevalence of end-stage renal disease requiring transplantation in India is estimated to be between 151 and 232 per million population [2].

With a growing burden of end-stage kidney disease, there is also a growing population of kidney transplant recipients worldwide. As kidney transplant recipients (KTRs) have multiple comorbidities and need constant monitoring of immunosuppressive medication doses, they need frequent follow-up with the nephrologist. The quality of follow-up has been shown to be a key factor for long-term graft survival [3,4]. Frequent follow-up can place substantial demands on patients and transplant programs, particularly in resource-limited settings where specialist services are concentrated in tertiary centers.

In a developing country such as India, where the burden of ESKD is substantial, many patients travel long distances from rural and remote areas to tertiary care centers for kidney transplantation. Post-transplant care often requires repeated travel for scheduled follow-up visits and for the evaluation and management of infections, graft dysfunction, and other medical or surgical complications.

The COVID-19 pandemic created additional barriers to routine outpatient care because of travel restrictions, reduced healthcare capacity, and the increased risk of infection among immunocompromised patients. Telenephrology services were therefore introduced at our center to facilitate continued specialist follow-up. Telemedicine may reduce travel and associated costs while allowing clinicians to review laboratory results, home blood pressure and blood glucose measurements, symptoms, and medication-related concerns.

Although virtual care has subsequently become an established component of healthcare delivery, evidence specific to kidney transplantation remains heterogeneous, particularly regarding patient experience and the practical challenges of delivering care in public sector and resource-constrained settings. Recent transplant studies have also emphasized that virtual care may complement rather than replace in-person visits. We therefore conducted this study to assess the experience and acceptance of telenephrology among kidney transplant recipients at a public sector tertiary care center in India. The primary objective was to assess patient-reported experience and acceptance of telenephrology. The secondary objectives were to describe the travel-related and financial burden of in-person follow-up, perceived benefits and limitations of telenephrology, and patient preferences for future follow-up after the resumption of routine outpatient services.

Materials And Methods

The All India Institute of Medical Sciences (AIIMS), New Delhi, is one of the largest public sector hospitals in the country, performing more than 140 kidney transplant surgeries annually. AIIMS provides transplant care to patients from Delhi and other parts of India, including neighboring northern states, many of whom travel long distances for treatment and follow-up.

At our center, kidney transplant recipients are reviewed twice weekly during the first three months after transplantation, weekly up to six months, and every two weeks up to one year, with laboratory monitoring and adjustment of immunosuppressive therapy. The frequency of visits was subsequently reduced according to the follow-up protocol and the patient's clinical status.

Telenephrology services were started at the institute during the COVID-19 pandemic in India. At the beginning of the COVID-19 pandemic, more than 2800 KTRs were under follow-up at our center, many of whom were within three months of transplantation. The telenephrology service for transplant patients was handled directly by the Department of Nephrology via WhatsApp® or voice call or e-mail. A dedicated smartphone handled by a nephrology trainee provided round-the-clock assistance. Patients could share laboratory reports and blood pressure and blood glucose recordings, and receive prescriptions through WhatsApp. When symptoms or findings required further evaluation, patients were advised to attend the hospital and were admitted when clinically indicated.

This study was designed as a single-center, cross-sectional study conducted to assess the acceptance and experience of telenephrology services among KTRs at AIIMS, New Delhi, India. The study included patients who had availed telenephrology services at least once between April 2020 and September 2020. A questionnaire was designed to collect data on sociodemographic characteristics, details about outpatient visits prior to and after the COVID-19 pandemic, patients' perceptions of the advantages and disadvantages of the use of telemedicine, barriers faced by the patients, and the need for hospital visits during this period. The study was approved by the Institutional Ethics Committee of All India Institute of Medical Sciences, New Delhi (approval number: IEC-922/04.09.2020).

A total of 100 patients were selected from the list of kidney transplant recipients who had availed teleconsultation during the study period using systematic sampling, with every fifth patient selected from the list. Each patient was contacted over the phone, and the purpose and methodology of the study were explained, following which oral consent was obtained. Subsequently, the questionnaire was administered in the local language, and the response was recorded. Overall patient satisfaction with the telenephrology follow-up service was assessed via a global 5-point Likert scale administered during the telephone interview. Participants graded their overall experience from 1 (very dissatisfied/least desirable) to 5 (very satisfied/most desirable). The survey was administered in the patient's preferred local language by the investigator. Responses were accessible only to the principal investigator, and participants were informed that their responses would not affect their future care. Descriptive statistics, including frequencies, means, medians, and ranges, were generated using IBM SPSS Statistics for Windows version 23.0 (IBM Corp., Armonk, NY).

Results

The mean age of our study cohort was 32.83 ± 9.96 years (range: 16-55 years), and 92 (92%) were males. The median number of teleconsultations availed by the patients was 5 (1-20) over the six-month period. The questionnaire was answered by the patient himself/herself in 89 (89%) cases, spouse in 7 (7%), children in 3 (3%), and other relatives in 1 (1%).

A total of 39 (39%) participants were graduates or postgraduates, while 46 (46%) had completed the 10th or 12th standard. One-third of participants were unemployed and dependent on family members for financial

support. According to the modified Kuppuswamy classification, 51 (51%) participants belonged to the lower-middle socioeconomic class and 30 (30%) to the upper-middle socioeconomic class [5]. Overall, 54 (54%) participants lived in urban or semi-urban areas, while 46 (46%) participants were from villages. The median one-way distance to the hospital for physical outpatient visits was 304.5 km (range: 6-1673 km), and 87 (87%) patients depended on public transport. The median number of outpatient visits per patient per year was 12 (range: 4-24) (Table *1*).

Characteristic	Number (%)
Age, years (mean ± SD)	32.83 ± 9.96
Range	16-55
Sex	
Male	92 (92%)
Female	8 (8%)
Education	
Graduate/postgraduate	39 (39%)
10th/12th standard	46 (46%)
Other	15 (15%)
Employment status	
Unemployed/dependent on family	33 (33%)
Employed	67 (67%)
Socioeconomic status	
Lower-middle	51 (51%)
Upper-middle	30 (30%)
Other	19 (19%)
Place of residence	
Village	46 (46%)
Town	31 (31%)
City	23 (23%)
Distance to transplant center, one way, km	
Median (range)	304.5 (6-1673)
Mode of transport	
Public transport	87 (87%)
Other	13 (13%)
Outpatient visits per year	
Median (range)	12 (4-24)
Stayed near hospital during visits	62 (62%)
Paid accommodation (hotel/lodge/rental)	46 (46%)
Free government accommodation	7 (7%)
Stayed with friends/relatives	9 (9%)
Other/no stay near hospital	38 (38%)
Stayed ≥4 days during hospital visit	47 (47%)
Accompanied during hospital visits	79 (79%)

Spouse	34 (34%)
Parent	23 (23%)
Other	22 (22%)
Reported productivity loss	57 (57%)
Cost of physical visit, INR	
Median (range)	3000 (40-15,000)

TABLE 1: Baseline characteristics of the study population

SD: standard deviation

During hospital visits, 62 (62%) participants stayed near the hospital. Additionally, 46 (46%) participants stayed in paid accommodation such as hotels or lodges, 7 (7%) used free government accommodation, and 9 (9%) stayed with relatives. A total of 47 (47%) participants stayed for four or more days during a typical visit to complete investigations, including tacrolimus levels, and consult the nephrologist. Overall, 79 (79%) participants were accompanied by another person, most commonly a spouse (n=34, 34%) or parent (n=23, 23%). Furthermore, 57 (57%) participants reported productivity loss because of missed work days. The median reported cost of a physical visit was INR 3000 (range: INR 40-15,000) (Table *1*).

Regarding teleconsultation, 98 (98%) participants were confident expressing their concerns by telephone and 99 (99%) were comfortable sharing test reports by telephone. Overall, 99 (99%) participants rated their telenephrology experience 4 or 5 on the 5-point Likert scale (Figure *1*). When asked to compare teleconsultation with physical consultation, 16 (16%) participants considered teleconsultation better, 28 (28%) considered both modalities equally good, and 56 (56%) considered teleconsultation acceptable during the COVID-19 pandemic but preferred continuation of physical consultations (Table *2*).

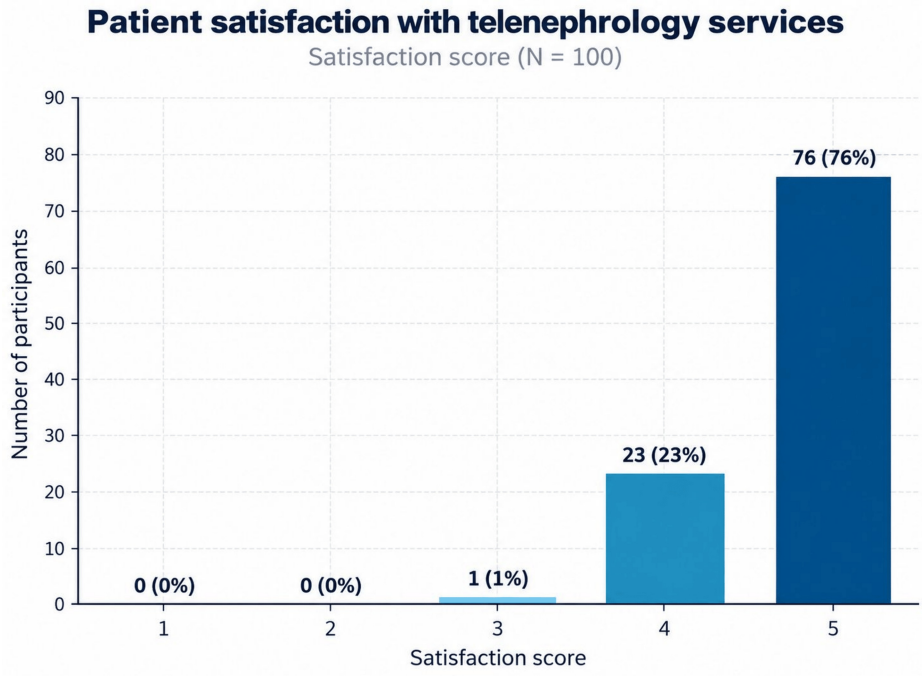


FIGURE 1: Patient satisfaction score for telenephrology services

Variable	Number (%)
Respondent	
Patient	89 (89%)

Spouse	7 (7%)
Child	3 (3%)
Other relative	1 (1%)
Confidence in expressing concerns by telephone	
Yes	98 (98%)
No	2 (2%)
Comfortable sharing test reports by telephone	
Yes	99 (99%)
No	1 (1%)
Overall telenephrology experience	
Score 5	76 (76%)
Score 4	23 (23%)
Score 3	1 (1%)
Score 2	0 (0%)
Score 1	0 (0%)
Comparison with physical consultation	
Teleconsultation better	16 (16%)
Both equally good	28 (28%)
Teleconsultation acceptable during COVID-19 pandemic, but physical consultation preferred	56 (56%)
Hospital visit during the six-month study period	
Yes	42 (42%)
No	58 (58%)
Reason for hospital visit	
Medication-related	8 (8%)
Laboratory investigations	13 (13%)
Symptoms/complaints	21 (21%)
Most important perceived benefit of teleconsultation	
Savings in travel, accommodation, and lost work time	79 (79%)
Reduced risk of infection	13 (13%)
Avoidance of travel-related difficulties/fatigue	8 (8%)
Preferred mode after resumption of regular outpatient services	
Teleconsultation alone	2 (2%)
Physical consultation alone	1 (1%)
Combination of teleconsultation and physical consultation	97 (97%)
Most commonly reported limitation	
Lack of physical presence of doctor	22 (22%)
Difficulty explaining clinical symptoms	2 (2%)
Non-availability of local laboratory investigations	5 (5%)
Higher cost at private diagnostic centers	3 (3%)

TABLE 2: Patient experience and acceptance of telenephrology services

A total of 42 (42%) participants visited the hospital at least once during the six-month period. Reasons included evaluation of symptoms or intercurrent complaints in 21 (21%) patients, laboratory monitoring in 13 (13%) patients, and procurement of post-transplant medications in 8 (8%) patients. Overall, 5 (5%) patients were admitted during this period; three were COVID-19-positive.

The most frequently reported benefit of teleconsultation was saving the costs associated with travel, accommodation, and lost work time, noted by 79 (79%) patients. Other perceived benefits included reduced risk of potential infection reported by 13 (13%) patients and avoidance of travel-related fatigue or difficulty cited by 8 (8%) patients. Following the resumption of regular outpatient services, 97 (97%) patients favored a combination of teleconsultation and in-person consultations (Figure *2*). The most common limitation was the lack of physical presence of the doctor, reported by 22 (22%) patients. Other limitations were less frequently reported and included difficulty explaining clinical symptoms in 2 (2%) patients, lack of local laboratory facilities in 5 (5%) patients, and higher costs at private diagnostic centers in 3 (3%) patients.

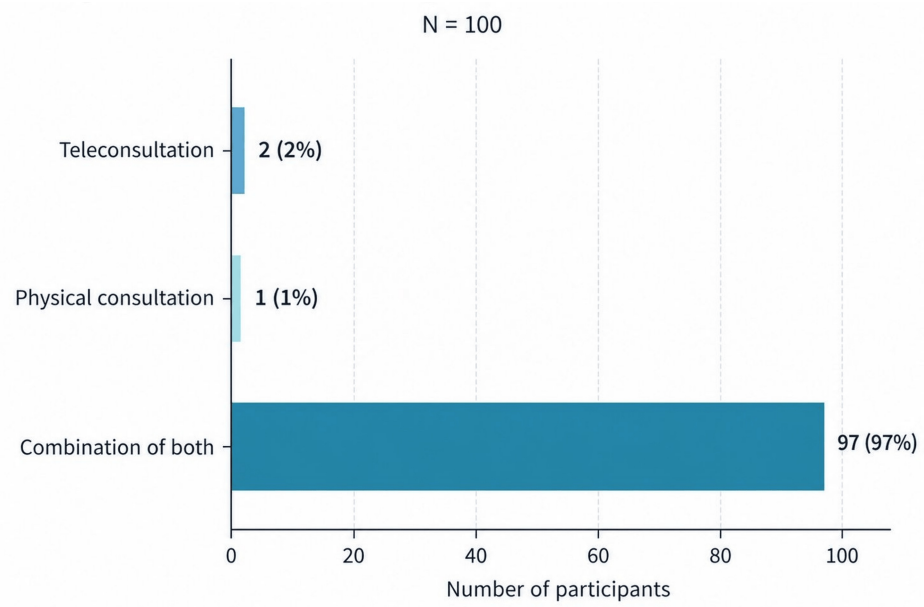


FIGURE 2: Preferred mode of outpatient consultation by study participants

Discussion

There is a huge burden of kidney disease in India, with approximately one in six adults suffering from chronic kidney disease (CKD) [6]. As the prevalence of CKD is increasing, there is an increasing population of KTRs. For a country where 65% of the total population resides in rural areas with poor accessibility to specialist nephrology care and a critical shortage of nephrologists (less than one nephrologist per million population) [7,8], this amounts to a huge burden on the few transplant centers and transplant physicians.

The main finding of our study was that telenephrology was well accepted by kidney transplant recipients who used the service. However, most patients preferred a combination of teleconsultation and in-person visits rather than teleconsultation alone. Our study also highlights the considerable geographic and financial burden faced by patients who need to travel to a public sector transplant center for regular follow-up. Participants travelled a median of 304.5 km one way to attend the physical outpatient clinic, and the range extended to 1673 km. Most depended on public transport, many required accommodations near the hospital, and nearly four-fifths were accompanied by another person. More than half reported productivity loss, and the median reported cost of a visit was INR 3000. These findings highlight that the burden of transplant follow-up extends beyond the hospital visit itself and includes reported travel-related expenses, accommodation costs, and productivity loss for patients and their families.

Distance from transplant centers is an important determinant of access to transplantation and post-transplant care. Previous work by Axelrod et al. has demonstrated associations between socioeconomic

disadvantage, geographic distance, and access to transplantation and outcomes [9]. In our setting, the large distances travelled by patients support the potential value of remote consultations for selected follow-up encounters, particularly when laboratory testing can be performed locally and the patient does not require physical examination [9]. As a referral center, our institution caters to a large population of patients from across the country, many of whom travel long distances for each outpatient visit and, in some cases, stay for several days near the hospital.

Kidney transplant recipients require lifelong monitoring of graft function, immunosuppressive therapy, infections, and other complications [10]. The COVID-19 pandemic accelerated the use of telemedicine because routine in-person services were disrupted and infection exposure was an important concern. However, the present study should be interpreted as an assessment of patient experience and perceived acceptability rather than evidence of clinical effectiveness or safety.

Our findings are consistent with previous studies showing that telemedicine can improve access and reduce travel burden for kidney transplant recipients [11-14]. A randomized study of telemedically supported follow-up in living-donor kidney transplant recipients also reported benefits in selected aspects of aftercare [15].

A study from New York reported that telemedicine was feasible for both routine and for-cause visits among transplant recipients during the COVID-19 pandemic [16]. Earlier studies from the UK and Australia also suggested that telehealth could be used for routine follow-up of kidney transplant recipients, with potential benefits in terms of access to care and patient empowerment, while reducing the need for travel [17,18]. Similar findings have been reported from India. An observational cohort study from a public sector institute in western India found that telemedicine helped maintain continuity of care for kidney transplant recipients during the COVID-19 pandemic. The program also facilitated doorstep delivery of essential immunosuppressive medications during the national lockdown. Acceptance of telemedicine was higher among younger and middle-aged patients than among older patients [19]. More recent transplant-specific evidence is particularly relevant: a 2024 cohort study comparing predominantly virtual and in-person care after kidney transplantation found similar short-term graft and clinical outcomes, while patients receiving virtual care had substantially less travel. These findings support the feasibility of virtual care but also highlight the importance of appropriate patient selection and local laboratory monitoring [20]. The convenience of consulting from home or the workplace may also help patients feel more involved in their own care irrespective of the geographical location. Similar benefits of telemedicine have been reported in previous studies [21].

The economic and logistical burden identified in our cohort may be particularly important in the Indian public sector setting. Many participants belonged to lower-middle or upper-middle socioeconomic groups, and one-third were unemployed or dependent on family members for financial support. Participants perceived savings in travel, accommodation, and lost work time as a major benefit of telenephrology. However, because the study did not compare costs before and after the implementation of teleconsultation or undertake a formal economic evaluation, these findings should be interpreted as perceived benefits rather than demonstrated cost savings or cost-effectiveness. Frequent outpatient visits can contribute substantially to the environmental impact of healthcare, particularly through travel to and from healthcare facilities [22]. By reducing the need for some in-person visits, telenephrology may also reduce travel-related emissions. Telehealth therefore has the potential to contribute to more environmentally sustainable healthcare delivery [18]. The potential environmental benefits of reducing travel also warrant further assessment.

Patient preference in our study is especially informative. Although 98 (98%) participants were confident expressing concerns by telephone and 99 (99%) were comfortable sharing reports, only 16 (16%) participants considered teleconsultation better than physical consultation. More than half regarded teleconsultation as acceptable during the pandemic but still preferred physical consultations. Thus, high acceptability of remote communication should not be interpreted as a preference for complete replacement of in-person care. This preference for a hybrid model is consistent with more recent qualitative work among kidney transplant recipients, which identified reduced travel time and financial burden as important advantages of telemedicine while also highlighting limitations of remote physical examination and the importance of maintaining in-person care [23]. The finding that 97 (97%) participants preferred a combination of teleconsultation and in-person visits is particularly relevant to post-pandemic transplant care.

Patient education on using technology to share reports and receive prescriptions over the phone may improve the uptake of telenephrology. Remote telemedicine clinics linked with local physicians, nurses, or trained technicians could also help patients connect with the nephrologist without having to travel to the transplant center. The most commonly reported limitation in our study was the lack of physical presence of the doctor. Video consultations may address this to some extent, although they cannot completely replace a physical examination. At the same time, most participants in our study had at least a secondary school education and belonged to the lower-middle or upper-middle socioeconomic groups. This suggests that patients from less educated or lower socioeconomic backgrounds may face greater barriers to accessing telemedicine, particularly when such services are introduced for the first time. Improving awareness, providing basic training, and involving local healthcare providers may therefore be important for making

telenephrology more accessible to a wider group of transplant recipients.

The strengths of this study include its focus on a public sector transplant center serving patients from a wide geographic area and its detailed assessment of the travel and practical burden of conventional follow-up. This study has several limitations. First, only kidney transplant recipients who had used telenephrology were included. Their experience may not reflect that of patients who could not access the service or chose not to use it, and the high acceptance ratings should therefore not be generalized to all transplant recipients. Second, overall experience was assessed using a study-specific, single-item 5-point Likert scale rather than a formally validated patient experience instrument. Third, 11% of responses were provided by relatives rather than the patients themselves, which may have influenced subjective assessments of experience and acceptance. Fourth, travel-related costs and productivity loss were self-reported, and the study was not designed as a formal economic evaluation. The findings should therefore be interpreted as reported burden and perceived benefits rather than demonstrated economic effectiveness. Fifth, the data were collected during the COVID-19 pandemic, when infection concerns and disruptions to routine services may have influenced patient preferences. Finally, this was a single-center descriptive study without a comparator group or assessment of graft function, rejection, hospitalization, or other clinical outcomes. The study therefore cannot establish the clinical effectiveness or safety of telenephrology, and its findings should be interpreted as patient-reported experience and perceived acceptability.

Future prospective comparative studies should determine which transplant recipients and which types of follow-up encounters can safely and effectively be managed remotely, and how the proportion of virtual and in-person visits should be individualized according to clinical need, distance from the transplant center, availability of local investigations, and patient preference. Such studies should also assess whether remote care can improve access without widening disparities among patients with limited digital literacy or unreliable access to technology.

Conclusions

In this single-center study, kidney transplant recipients who had used telenephrology generally reported a positive experience and perceived benefits in terms of travel-related and financial burdens. However, most participants preferred a combination of teleconsultation and in-person visits. These findings support the use of telenephrology as an adjunct to, rather than a replacement for, in-person transplant follow-up. Further prospective studies incorporating clinical outcomes, economic assessments, and patients who do not use telemedicine are needed to better define the role of hybrid follow-up in kidney transplantation.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Arunkumar Subbiah, Raj K. Yadav, Soumita Bagchi, Sandeep Mahajan, Sanjay K. Agarwal, Dipankar Bhowmik

Acquisition, analysis, or interpretation of data: Arunkumar Subbiah, Kristin George

Drafting of the manuscript: Arunkumar Subbiah, Kristin George

Critical review of the manuscript for important intellectual content: Arunkumar Subbiah, Kristin George, Raj K. Yadav, Soumita Bagchi, Sandeep Mahajan, Sanjay K. Agarwal, Dipankar Bhowmik

Supervision: Arunkumar Subbiah

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. The Institutional Ethics Committee of All India Institute of Medical Sciences, New Delhi issued approval IEC-922/04.09.2020. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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