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Challenges of continuation of live liver donor programme during COVID-19 pandemic in Pakistan: outcomes and lessons learned

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ABSTRACT

Background COVID-19 pandemic has globally affected healthcare including the transplantation programmes.

Materials and methods We retrospectively studied the impact of COVID-19 on live liver donor (LLD) programme at liver transplant centre in Gambat, Pakistan. Standard operative procedures (SOPs) including COVID-19 nasopharyngeal swab PCR, CT scans, personal protective equipment use, 6-feet distancing were developed for LLD and transplant team to mitigate COVID-19 exposure. We compared the complications, healthcare utilisation (hospital stay, readmission) and mortality between two LLD cohorts—before and during COVID-19 pandemic from March 2019 to December 2020.

Results During study period 300 LLD surgeries were performed. There was an increase in rate of LLDs from 132 (44%) in pre-COVID to 168 (56%) during COVID-19 era. Average numbers of transplants per month performed during pre-COVID and during COVID-19 era were 10.1 and 14, respectively. No donor has developed COVID-19 infection during hospitalisation. Rate of all LLD complications (32 (21.47%) and 49 (29.16%), p=0.43), uneventful discharges (120/168 (71.4%) and 88/132 (66.6%), p<0.05), mean hospital stay (6±2 days and 5±2 days, p=0.17) and readmission (5 (4%) and 3 (1.8%), p=0.43) were similar during the pre-COVID and COVID-19 era. No donor mortality was observed during study period.

Conclusion With the implementation of mindful SOPs, rate of LLD increased without any case of COVID-19 infection. Our SOPs were helpful in continuation of LLD programme in a developing country during COVID-19 pandemic.

Summary box

What is already known about this subject?

- ► COVID-19 pandemic has globally affected healthcare including the transplantation programmes especially emerging liver transplant centres.

What are the new findings?

- ► Standard operative procedures (SOPs) including COVID-19 nasopharyngeal swab PCR, CT scans, personal protective equipment use, 6-feet distancing were developed for live liver donor (LLD) and transplant team to reduce COVID-19 exposure.
- ► There was an increase in rate of LLDs from 132 (44%) in pre-COVID to 168 (56%) during COVID-19 era.
- ► No donor has developed COVID-19 infection during hospitalisation. Rate of all LLD complications (32 (21.47%) and 60 (40.5%)), uneventful discharges (120/168 (71.4%) and 88/132 (66.6%)), mean hospital stay (6±2 days and 5±2 days) and readmission (5 (4%) and 3 (1.8%)) were similar during the pre-COVID and COVID-19 era, (p value: not significant).
- ► No donor mortality was observed during the study period.

How might it impact on clinical practice in the foreseeable future?

- ► With the implementation of mindful SOPs, rate of LLD increased without any case of COVID-19 infection.
- ► Our SOPs were helpful in continuation of LLD programme in a developing country during COVID-19 pandemic.

INTRODUCTION

COVID-19 pandemic by SARS-CoV-2 has drastically affected the global healthcare system. COVID-19, being a novel infection at the beginning of 2020, with continuing information about its spread and control has hugely influenced the healthcare including solid organ transplantation (SOT). The number of SOTs has plummeted because of the concern for the infection spreading in immunosuppressed patients, donors and healthcare workers. Registry data from University of Washington showed that the risk of

contracting SARS-CoV-2 in SOT recipients is comparable to general population, however, with advanced age and comorbid conditions increased rate of infection is seen. A systematic review on outcomes of SOT in patients with COVID-19 reported the outcomes. It showed that fatality rate among 16 patients with liver transplantation (LT) was 37.5%.[1–6] Asian Pacific Association for Study of Liver has proposed to prioritise LT in patients with acute liver failure, ACLF, high MELD score and HCC at upper limits of Milan criteria. Due to recommendations and shortage of resources including travel bans and odd circumstances, organ procurement activities are also affected.[7]

Not only COVID-19 has reduced the rate of LTs but it has also impacted the rate of live liver donation at various centres globally. Coinciding with the peak of COVID-19 pandemic wave, donation for live organs such as kidney and liver slumped by approximately 86%. This is largely due to concerns about the live donor and recipient health amid ongoing pandemic crisis.[3] In various centres, live liver donor (LLD) surgeries were attempted to be continued with the various safety measures. Centres from India and Pakistan have reported reduction in volume of live donor liver transplantation (LDLT) and hence LLD surgeries.[8 9] Bhatti *et al* reported a reduction in LDLT rate from 11.5/month to 4.8/month in Pakistan. A letter to the editor from India reported successful continuation of their programme. Out of nine LDLTs performed in their centre, one donor could not be operated due to asymptomatic donor tested positive for COVID-19. However, they manage to continue their LLD programmes for patients with high MELD score and liver cancer.[8–10] Various strategies to mitigate postoperative SARS-CoV-2 infection for donors and recipients are proposed and practiced. These include routine health assessment, physical distancing, routine blood work, a CT of chest and intermittent nucleic acid test performed on the nasopharyngeal swab.[10]

To our knowledge, there is no exclusive report on the outcomes including complications and healthcare utilisation among LLDs during COVID-19 pandemic from the developing countries. In order to mitigate the risk of transmission of COVID-19 infection, we adapted mindful standard operative procedures (SOPs) at Pir Abdul Qadir Shah Jilani Institute of Medical Sciences (PAQSJIMS) Hospital, Gambat, Pakistan. We sought to study the outcomes of LLD programme at PAQSJIMS hospital, Gambat, Pakistan during COVID-10 pandemic.

PATIENTS AND METHODS

Study setting and design

This study was conducted at PAQSJIMS Hospital, Gambat, Pakistan, which is the first and only provincial government-funded centre for organ transplantation in the country started in 2016. We collected data variables of all our LDLT and LLD in a secure database. A retrospective study was performed to compare the rates of donation, complications, healthcare utilisation and outcomes of LLD between pre -COVID-19 (March 2019 to February 2020) and COVID-19 era (March 2020 to December 2020).

Box 1 Live liver donor evaluation process

Step 1
- Blood tests: grouping, complete blood count, prothrombin time/international normalised ratio, liver function tests, urea, glucose, albumin, creatinine, magnesium, electrolytes, urine R/E, HCV antibody, hepatitis B profile (hepatitis B surface antigen, hepatitis B core antibody, hepatitis B surface antibody), HIV 1 and 2 screen.
- Radiology: chest X-ray PA view.
- Cardiology: ECG.
- Consultation: transplant surgeon.

Step 2
- Radiology: liver dynamic CT scan.
- Radiology: MRCP.

Step 3
- Echo 2D with pulmonary pressure readings.
- Thrombotic screen: lupus anticoagulant, antithrombin III, protein S and C, anticardiolipin IgG, resistance V (factor V).
- Biochemistry: G6PD, reticulocyte count, sickle cell, haemoglobin A1c, lipid profile, thyroid function tests, serum ferritin, ceruloplasmin, alpha-1 antitrypsin.
- Immunology: IgA, IgG, IgM, ANCA, antinuclear antibody group (antinuclear antibody, antismooth muscle actin, antimitochondrial antibody), antibody screen, cytomegalovirus IgG.
- Consultations: psychiatrist, anaesthetist, hepatologist, independent assessor.

Donor selection criteria

LLDs were selected at PAQSJIMS after a detailed interview, physical health examination and laboratory investigations (box 1). We also performed assessment for psychological issues, any coercion and self-voluntariness for candidacy after sharing the details of the surgical procedure, risks of complications (10%–15%) and a 0.5% chance of death. Criteria used for donor selection includes, age between 18 and 40 years, body mass index (BMI) <30 kg/m^2, Landsteiner's ABO blood grouping compatibility, absence of comorbid conditions such as uncontrolled hypertension, hyperlipidaemia, diabetes mellitus, ischaemic heart disease and chronic respiratory diseases. We also ensure that donor is a blood relative, normal liver function tests (LFTs) including total bilirubin, ALT/AST, alkaline phosphatase and albumin and imaging of liver. We accepted Liver Attenuation Index >1, functional liver remnant (FLR) >30%, graft-to-recipient weight ratio (GRWR) ≥0.7 and acceptable vascular anatomy based on triphasic CT scan. Finally, we also performed magnetic resonance cholangiopancreatography (MRCP) for delineating biliary tree anatomy.

We rejected LLDs positive for the SARS-CoV-2 infection by nasopharyngeal swab testing, unwilling to donate at any stage of their evaluation, those with deranged LFTs and FLR <30%, portal vein type D and E, segment IV supplied by right hepatic artery intrahepatically (on

Box 2 Standard operative procedures (SOPs) during COVID-19 era

Donor SOPs

- Checking for the SARS-CoV-2 by nasopharyngeal swab on all the donors 2 days prior to the live liver donor (LLD) surgery.
- Predonation self-quarantine of the donors after SARS-CoV-2 by nasopharyngeal swab testing.
- HRCT 1 day prior to LLD.
- Managing donors in a separate donor intensive care unit (ICU) with separate nursing staff for each donor in every shift.
- Directly discharging our donors from ICU to home with advice and counselling about all SOPs.
- Follow-up of the donor at 1 week in surgical OPD with all SOPs for COVID-19. Then at 3-week and 3-month visits at our clinic by our surgeons.

Liver transplant team SOPs

- Daily checking the temperature of every team member on entrance to the hospital, asking for exposure to any patient with COVID-19 infection and for symptoms of COVID-19 infection.
- Ensuring washing hands with soap and water prior to and after attending a donor.
- Wearing mask during stay in the hospital.
- Wearing all the necessary personal protective equipment during the surgery and interventions.

Donor attendant policy

- Only one attendant was allowed to accompany the donor during the clinic visit and admission for LLD.
- Attendant was also screened for COVID-19 with the measures adapted for the team.

CT scan), more than three ducts (on MRCP). We also rejected donors with GRWR <0.70.

All donors were assessed by an independent physician not related to transplant team in order to avoid the influence of the liver surgical team. After completion of the evaluation, informed consent was obtained from the donors with an understanding of voluntary nature of donation and backing out at any time prior to surgery. Approval from the Human Organ Transplant Authority, Pakistan was sought for all the donors.

Multiple mindful SOPs were developed in order to mitigate the risk of transmission of SARS-CoV-2 infection from donor to recipient and to the team of transplant at our institute. These SOPs are described in box 2.

LLD operation

A standardised surgical procedure for LLD under general anaesthesia with invasive monitoring was performed. Abdominal wall was opened by a reverse L-incision, laparotomy was performed for assessment of liver volumes and explored to rule out any unforeseen abdominal pathology. Right lobe of liver was mobilised by dividing the triangular/falciform ligament. Right lobe was flitted off the IVC by dividing small caudate branches. Right hepatic vein (RHV) was dissected and slinged. Retrograde cholecystectomy was done and cholangiogram was done for assessment of biliary anatomy. Right hepatic artery (RHA) and right portal vein (RPV) were dissected and slinged with vascular sling. RHA and RPV were temporarily clamped with atraumatic clamps and transaction line was marked and inflow to the right lobe was established by releasing the clamps. Right/left hepatectomy was performed by using Soring/waterjet and bipolar diathermy, suture ligating all major branches of vessels and biliary radicals on the transaction plane. Pringle clamping was not done during transaction routinely. Biliary confluence was divided to obtain single/double ducts in right/left hepatectomy by extrahepatic Glissonion Pedicle approach. Stump on the common hepatic duct was closed in single layer with fine 6/0 PDS. Once transaction was completed, RHA, RPV and RHV were clamped and divided to take out right lobe graft. Remaining stumps were closed with fine non-absorbable sutures. Finally, a completion cholangiogram was done to check for any bile leaks or narrowing. Abdomen closed with non-absorbable sutures after subhepatic drain placement.

Postoperative management

Donors were extubated after the completion of hepatectomy in the operation room and shifted to intensive care unit (ICU) for continuation of invasive monitoring. Postoperative pain was managed with the help of epidural analgesia using 0.125% bupivacaine. Broad spectrum antibiotics and fluids and electrolytes were managed according to the ICU protocols. On first postoperative day, donors were mobilised out of bed. Nasogastric tube was removed and allowed oral liquids intake. On third postoperative day, epidural catheter, Foley's catheter and arterial line were removed and patient shifted from ICU to high dependency unit.

Outcomes

Various outcomes were studied between the two cohorts of donors including (1) rate of LLD, (2) complications, (3) healthcare utilisation (length of ICU stay, length of hospital stay and readmission), (4) rate of SARS-CoV-2 infection and (4) mortality. Complications were assessed according to Clavien-Dindo (CD) classification.

The SARS-CoV-2 test kit (real-time PCR) is an in vitro diagnostic real-time reverse transcription PCR (rRT-PCR) assay for qualitative detection of nucleic acid from SARS-CoV-2 in nasopharyngeal/oropharyngeal swabs. Samples were collected from anterior/mid-turbinate nasal swabs, nasopharyngeal washes/aspirates or nasal aspirates specimens from all donors and suspected healthcare providers. This test kit has been reported to have a sensitivity of 77% (95% CI: 73% to 81%) in detecting SARS-CoV-2 infection using rRT-PCR technique on nasopharyngeal swabs.[11]

Statistical analysis

Data of the donor demographics, clinical, surgical characteristics and outcomes were compared between two eras. Arithmetic mean was calculated for the quantitative variables and percentages were calculated for qualitative

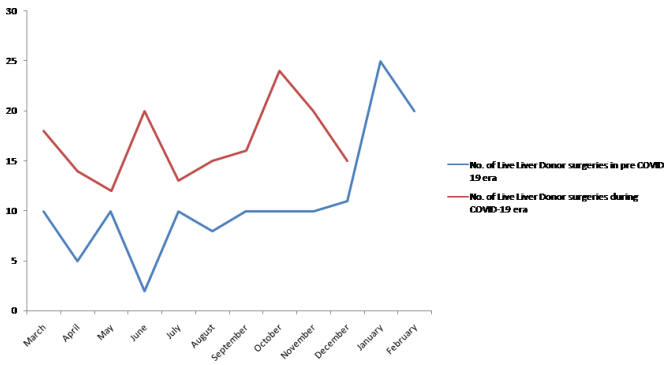

Figure 1 Month-wise trend of live liver donor surgeries during pre-COVID-19 era (March 2019 to February 2020) and COVID-19 era (March 2020 to December 2020).

variables. Qualitative variables like CD classification of complications including minor complications, respiratory complications, abdominal complications and biliary complications were compared between two groups by using the χ^2 test. The quantitative variables used for comparison were duration of ICU stay, duration of hospital stay and FLR and so on by independent sample t-test. A p value <0.05 was considered statistically significant. The data were analysed by using SPSS V.25. This study was approved by our hospital's Institutional Ethical Review Board.

RESULTS

Since the inception of LDLT programme at our centre, a total of 406 LLD surgeries have been performed. A total of 300 LLD surgeries were performed during the study period. Sixty donors were rejected based on our inclusion and exclusion criteria; off note, three donors were positive for SARS-CoV-2 on nasopharyngeal swab at screening and rejected.

Trends and demographics

Increasing trend of LLDs was observed during the COVID-19 era (March 2020 to December 2020; n=168; 56%) as compared with pre-COVID-19 era (March 2019 to February 2020; n=132; 44%) (figure 1). Average numbers of transplants per month performed during pre-COVID and during COVID-19 era were 10.1 and 14, respectively. In pre-COVID era, mean age of donors was 23.82±5.82 years including 77 (58.4%) males and 55 (41.6%) females. During COVID-19 era, mean age of donors was 22.74±6.45 years including 104 (61.9%) males and 64 (38.1%) females. Blood group O was the the most common among our donors (66 in pre-COVID and 81 in COVID-19 era) followed by B (38 and 49) and A (24 and 33). No differences in the mean BMI of the donors in pre-COVID (21.40±2.99 kg/m^2) and COVID-19 era (22.1±2.89 kg/m^2) were observed, p value:0.69 (table 1).

Complications among LLDs

Mean operation time in pre-COVID-19 era and COVID-19 era were 6.5±1.2 hours and 6.0±1.1 hours, respectively. During the pre-COVID era, 15 (11.32%) and 29 (21.9%) donors developed CD grade 1 and 2 and grade 3 and 4A complications, respectively. Among grade 3 and 4A complications were sympathetic pleural effusion requiring thoracentesis in 9 (6.8%), biliary leakage requiring endoscopic retrograde cholangiopancreaticography (ERCP) with biliary stenting in 3 (2.3%) and in 4 (3.2%) donors requiring intra-abdominal drain placements. Reoperation during post-operative period was needed in 6 (4.8%) donors; one for secondary abdominal closure for wound dehiscence, one for peritonitis due to perforation of Meckel's diverticulum and one for subacute intestinal obstruction and three for haemoperitoneum due to drain site and perihilar region bleed. One (0.8%) donor was reintubated in ICU on the fourth postoperative day due to apnoea of unknown origin.

In pre-COVID era, 88 (66.6%) donors were discharged from hospital uneventfully without any complication as compared with 120 (71.4%) during the COVID-19 era, p value <0.05). However, 17 (10.1%) and 31 (18.4%) donors developed CD grade 1 and 2 and grade 3 and 4A complications, respectively. Out of those donors who developed grade 3 and 4A complications, 10 (6%) required thoracentesis for sympathetic pleural effusion, 5 (3 %) required abdominal drains for collections and biloma, 3 (1.8%) required ERCP with biliary stenting due to biliary leakage and stenting. Reoperation during postoperative period was needed in 5 (3%) donors for haemoperitoneum due to perihilar region bleed. One (0.6%) donor had pulmonary embolism during ICU stay and was reintubated. All these complications were managed successfully and no mortality was observed (table 2). There was no statistically significant difference in complications between the donors in pre-COVID and COVID-19 era (table 2).

Healthcare utilisation (ICU stay, length of stay, readmissions)

Mean ICU stay was 3±1 days as compared with 2.53±1 days in pre-COVID and COVID-19 era, respectively, p value: 0.15. Similarly, mean length of stay in hospital was 6±2 days and 5±2 days during pre-COVID and COVID-19 era, respectively, p value: 0.17. Five (4%) donors were readmitted during pre-COVID and 3 (1.8%) were readmitted during COVID-19 era, p value: 0.18. However, we found that significantly increased LLDs were discharged within 5 days in COVID-19 era (160; 95.2%) as compared with pre-COVID (91; 68.9%), p value<0.05.

SARS-CoV-2 infections

Out of all the LLDs who underwent surgery during the study period none was positive for SARS-CoV-2.

Table 1 Comparison of demographics and surgical features of LLDs in pre-COVID-19 and COVID-19 era

Variables	Pre-COVID-19	During COVID-19	P value
Mean age (years)	23.82±5.82	22.74±6.45	0.17
Mean BMI (kg/m^2)	21.40±2.99	22.1±2.89	0.69
Gender			
Male	77 (58.4%)	104 (61.9%)	0.07
Female	55 (41.6%)	64 (38.1%)	
Marital status			
Unmarried	87 (65.9%)	127 (75.5%)	0.06
Married	44 (33.3%)	41 (24.4%)	
Donors relation to recipients			
Son	25 (18.93%)	31 (18.5%)	0.35
Brother	21 (15.9%)	33 (19.6%)	
Nephew	19 (14.4%)	10 (6%)	
Daughter	18 (13.63%)	19 (11.3%)	
Sister	14 (10.6%)	12 (7.1%)	
Father	2 (1.5%)	17 (10.1%)	
Swap	4 (3%)	2 (1.2%)	
Others	289 (21.3%)	44 (26.19%)	
Type of graft			
Modified right lobe graft	110 (83%)	145 (86.3%)	NS
Modified extended right lobe graft	14 (10.5%)	11 (6.5%)	
Partial right lobe graft	4 (3%)	7 (4.2%)	
Left lobe graft	3 (2.3%)	4 (2.4%)	
Left lateral segment graft	1 (0.8%)	1 (0.6%)	
FLR			
≤30%	5 (3.8%)	7 (4.2%)	NS
31%–35%	40 (30.3%)	54 (32.1%)	
36%–40%	66 (50%)	79 (47%)	
>40%	21 (15.9%)	28 (16.6%)	
GRWR			
0.7–0.9	40 (30.3%)	49 (29.2%)	NS
0.91–1.0	33 (25%)	23 (13.7%)	
1.1–2.0	55 (41.7%)	90 (53.5%)	
>2.0	4 (3%)	6 (3.6%)	
Mean cold ischaemia time (minutes)	12.7±7 .32	9.5±6.12	0.095
Mean operation time (hours)	6.5±1.2	6.0±1.1	0.65
Mean blood loss (mL)	600±110	550±150	0.23
Blood transfusions (no of patients/%)	7 (5.3%)	11 (6.6%)	0.12

BMI, body mass index; FLR, future liver remnant; GRWR, graft-to-recipient weight ratio; ICU, intensive care unit; NS, not significant.

Moreover, none of the staff of our LT centre was found to be positive for COVID-19.

Mortality

There was no donor mortality observed during the pre-COVID and COVID-19 era in our study(table 2).

DISCUSSION

In the majority of South East Asian countries including Pakistan, LDLT is the only option for a lifesaving surgery in patients with end-stage liver diseases (ESLDs). Moreover, LDLT is the major alternate to deceased donor liver transplant (DDLT) in most countries due to the unmet demand.

Table 2 Various outcomes in LLDs during pre-COVID and COVID era

Variable	Pre-COVID-19	During COVID-19	P value
Total number of complications	44 (33.3%)	49 (29.16%)	0.43
Grade 1 and 2			
Wound infections	4 (3.2%)	6 (3.6%)	
Wound haematoma	2 (1.6%)	1 (0.6%)	0.12
UTI	4 (3.2%)	2 (1.2%)	
Fever	3 (2.3%)	7 (4.2%)	
Paralytic ileus	2 (1.6%)	1 (0.6%)	
Grade 3A			
Bile leakage	7 (5.35%)	7 (4.2%)	
Bile duct stricture	0	1 (0.6%)	0.15
Postop bleeding	3 (2.3%)	4 (2.4%)	
Pleural effusion/aspiration	9 (6.8%)	10 (6 %)	
ERCP and stenting	3 (2.3%)	3 (1.8%)	
Grade 3B			
Reopen	6 (4.8%)	5 (3%)	0.45
Grade 4A			
Need ICU care/ventilator	1 (0.85%)	1 (0.6%)	0.95
Grade 4B			
Multiorgan failure	0	0	–
Grade 5	0	0	–
SARS-CoV-2 positive	–	0	–
Mean ICU stay (days)	3±1	2.53±1	0.15
Mean hospital stay (days)	6±2	5±2	0.17
Discharge within 5 days	91 (68.9%)	160 (95.2%)	<0.05
Mortality	0	0	–

ERCP, endoscopic retrograde cholangiopancreaticography; ICU, intensive care unit; NS, not significant; UTI, urinary tract infections.

LDLT has been proven to reduce patient waiting time and mortality on waiting list in regions with DDLT option. During COVID-19 pandemic, we adapted mindful SOPs in order to continue our LLD programme. These SOPs helped us in continuation of our LLD programme to provide life-saving surgery to our very sick patients with ESLD. In this study, we reported that the rate of LLD increased during COVID-19 era as compared with pre-COVID-19 era (56% to 44%). Despite increased rate of LLD surgeries, complications according to CD classification were similar. Finally, healthcare utilisation including ICU stay and total length of stay were also comparable in two eras. Interestingly, we found that increased number of LLDs were discharged within 5 days during the COVID-19 era (160; 95.2%) as compared with pre-COVID-19 (91; 68.9%) era. To our knowledge, this is the first exclusive report of continuation of LLD surgery during the COVID-19 pandemic to benefit patients with ESLD in a developing country. Not only we manage to continue our services but also increased the rate of LLD surgery during the COVID-19 pandemic with the help of mindful SOPs.

Approximately 90% of the liver grafts in South East Asian countries including India and Pakistan come from live donor. In order to continue with LLD programmes Liver Transplant Society of India has recommended to continue programme for sick patients with high MELD scores and liver cancer.[10 11] During COVID-19 pandemic, majority of LT centres have restructured and reduced their transplant activities as a measure to mitigate the exposure to recipients and donors. With these approaches, various LDLT centres from South East Asia have reported their experiences of COVID-19 and LT. Soin *et al*[8] from India and Bhatti *et al*[9] from Pakistan reported their experience focus on outcomes of recipients at their LT programme. Soin *et al* compared the transplant activity in pre-COVID era (March to June 2019) with COVID-19 era (March to June 2020). Reduced rate of LDLT during COVID-19 (n=23) as compared with pre-COVID (n=39) were reported. They also reported transmission of COVID-19 among recipients and donors (3/71) and healthcare workers (8/125). Two recipients each died in the two eras. Bhatti *et al* also reported a drastic drop in their transplant volume from 11.5/month in pre-COVID-19 to 4.8/months during COVID-19 era. Three of their donors developed COVID-19 infection during evaluation. Another report by Jha *et al*[12] from India revealed that their transplant centre was closed at the beginning of COVID-19 pandemic. They restructured and started LDLT in April 2020. Between

April and September 2020 using the new protocols, they performed 20 LDLTs. Major complications were observed in 30% of recipients but none of the donors. A donor–recipient couple contracted COVID-19 after discharge from the hospital. Contrary to these reports focused on outcomes of liver recipients, we exclusively reported the meticulous outcomes of LLDs. We not only managed to continue LLD surgeries during COVID-19 era but also were able to increase the rate of donation. Despite increase in rate of LLDs, we reported comparable complications in pre-COVID and COVID-19 era. Our SOPs and mitigating strategies were successful in reducing transmission of COVID-19 infection in the donors. We also demonstrated reduction in length of stay during COVID-19 era.

Regardless of COVID-19 pandemic, overall incidence of morbidity and mortality in LLDs is reported invariably from single centres and databases. Many single-centre studies have reported complication rates after LLD surgery between 9% and 40%.[13–16] Jalil *et al* reported an overall complication rate of 42.8% among LLDs in the USA based on national database.[17] In our cohort of donors at Gambat, lesser overall complications rate (33% in pre-COVID and 28% in COVID-19 era) were experienced. Among those with complications, 10% had minor ones according to CD classification which is comparable with the reported literature.[17] Moreover the complication rates were similar in the pre-COVID and COVID-19 era LLDs. This is according to the principals of living donation which is to ensure donor safety and minimise the risk of potential complications. In our transplant centre in Gambat, Pakistan, we tried our best to follow the criteria for donor selection and did not compromise on the risk to donors. Mortality rate has been reported to be 0.1%–0.3% in different studies. Results of worldwide survey conducted among 148 programmes performing LDLT was published by Cheah *et al*.[14] Out of 148 programmes, 71 (48%) programmes in 21 countries completed the survey, including 11 553 LDLTs. According to this survey, donor mortality rate was 0.2% (23/11 553) with the majority of deaths occurring within 60 days of surgery, and all but four deaths were related to donation surgery. Jalil *et al*[17] has reported no mortality in their review of NRD from 2010 to 2017. Similarly, none of our LLD died during the study period, which is in line with international literature.

CONCLUSION

In conclusion, we reported a successful continuation of our LLD programme with increased rates of haepatectomy during COVID-19 pandemic with the help of mindful SOPs. Our mindful SOPs were successful in avoiding an outbreak of COVID-19 infection in our transplant centre. During COVID-19 pandemic, our complication rates, healthcare utilisation and mortality remained unaffected. Finally, we managed to continue our LLD programme and provided a lifesaving intervention to recipients with advanced cirrhosis successfully.

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