Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

of vaccination. Symptoms were variable but ranged from asymptomatic to acute respiratory failure. However, all patients had resolution of CMV DNAemia by the censor date with a range of 7 days to 45 days. Therapy included reduction of immunosuppression, intravenous ganciclovir, and oral valganciclovir. The median peak CMV DNA PCR in the cohort was 15,900 IU/ml with a range of 272 IU/ml to 175,973 IU/ml. None of the recipients developed IgG antibodies to SARS-CoV-2 in response to vaccination. There were no documented cases of COVID-19 in these transplant recipients.

Conclusion: CMV DNAemia after COVID-19 mRNA vaccination in solid organ transplant recipients may be an under-recognized phenomenon. Although the risk-benefit assessment strongly favors COVID-19 vaccination, due to the greater risk of adverse events with COVID-19 infection care teams should consider active monitoring for CMV disease activity in these patients. In some cases, CMV prophylaxis may be warranted depending on patients' risk profile. Our findings warrant study in a larger prospective study.

(1308)

Long Term Outcomes Following Double Lung Transplantation for Severe COVID-19 Infection

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Purpose: : Lung transplantation is a potentially lifesaving treatment for severe COVID-19 acute respiratory distress syndrome (ARDS), when optimized medical treatment fails to accomplish lung recovery. However, since the long-term outcomes remain unknown, concerns related to the use of lung transplantation in critically ill COVID-19 patients persist. In the current study, we evaluated consecutive patients that underwent lung transplantation for severe COVID-19 ARDS at our center and compared their post-transplant outcomes with those undergoing transplantation for non-COVID-19 pathology during the concurrent study period.

Methods: All consecutive patients undergoing lung transplantation between January 2020 to May 2021 were included. The study included two cohorts of patients that underwent transplantation for non-COVID-19 disease (nC19) or refractory COVID-19 ARDS (C19). For additional analysis, we included consecutive patients with severe COVID-19 that required veno-venous extracorporeal membrane oxygenation (ECMO).

Results: We found that post-procedure complications and length of stay were significantly greater compared to transplants performed for non-COVID-19 lung diseases during the concurrent study period. Following transplant the COVID-19 cohort demonstrated a more rapid improvement in Karnofsky performance status. At one year, all recipients in COVID-19 cohort were alive with post-transplant survival no different than institutional non-COVID-19 recipients. Furthermore, when compared to propensity-matched recipients from SRTR, post-transplant survival of institutional COVID-19 ARDS patients was non-inferior. There was progressive reduction in the probability of separation from extracorporeal membrane oxygenation (ECMO) with time and ECMO support greater than 30 days was associated with a significantly greater risk of death in patients with COVID-19 ARDS. In those who remained unweanable from ECMO after 30 days, lung transplant was an independent predictor of survival.

Conclusion: We conclude that lung transplantation in selected patients with severe COVID-19 ARDS who remain unweanable from extracorporeal life support can result in post-transplant outcomes comparable to recipients with chronic end-stage lung diseases and non-COVID-19 ARDS.

(1309)

COVID19 in Lung Transplanted Patients: Chronicles from an Italian Epicenter

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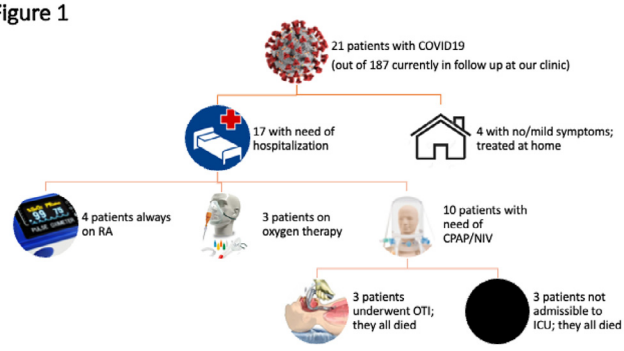
Purpose: Lombardy was one of the hardest hit regions in Italy during the COVID19 pandemic. We hereby report our experience with SARS-CoV2 infection in lung transplant recipients.

Methods: We retrospectively collected clinical data on all the consecutive cases of COVID19 in our centre, based in Milan, from March 2020 to August 2021. Diagnosis was always confirmed by a positive nucleic acid amplification test (RT-PCR) for SARS-CoV-2 on nasopharyngeal swab and/or tracheal aspirate.

Results: 21 patients were diagnosed with COVID19. Figure 1 summarizes the clinical course of these individuals. We reduced immunosuppressive regimen in all these patients, typically holding the antiproliferative agent and augmenting steroids; when hospitalized, everybody received initial empiric antibiotic treatment with piperacillin/tazobactam and high-dose LMWH. Hydroxychloroquine was used only in the "first wave" (4 patients). One patient was compassionately administered anakinra and remdesivir as a "rescue therapy". Lymphocitopenia was a common presenting sign (14 patients, 66%). Aspergillus co-infection occurred in 5 patients (24%). Mortality rate was 29%; 4 out of these 6 patients were affected by CLAD and 3 had chronic kidney disease. Of note, in March 2021, we tested all our patients for anti-SARS-CoV-2 nucleocapsid antibodies before starting vaccinations: we found three additional seropositive patients, who were not included in the present analysis, but had been presumably affected by an asymptomatic/mild form of the disease.

Conclusion: Apart from immunosuppression, the majority of our patients presented at least one risk factor for mortality in COVID-19 (diabetes, chronic kidney disease, arterial hypertension) and, for this reason, we felt that they should be hospitalized to enable close monitoring and prompt management of possible complications and deterioration. Clinical course seemed favorable in only two thirds of our patients but, for the time being, none of these individuals showed sign of new-onset CLAD after COVID19.

Figure 1



(1310)

Epidemiologic Analysis of Delta Variant SARS-CoV-2 in a Cohort of Lung Transplant Recipients

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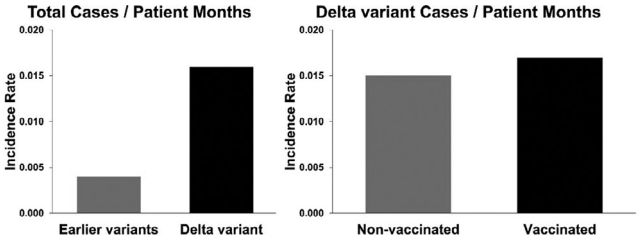
Purpose: Lung transplant (LTx) recipients have increased risk of infection with SARS-CoV-2 and have reduced efficacy from COVID-19 vaccination. The Delta variant of SARS-CoV-2 has increased virulence compared to earlier variants. We hypothesized that LTx recipients would have increased susceptibility to Delta variant infection despite vaccination.

Methods: We performed a retrospective cohort study of 314 LTx recipients followed between 1/1/2020-9/30/2021. Diagnosis of SARS-CoV-2 infection by PCR was recorded; Delta variant comprised >99% of strains from 6/1/2021-9/30/2021. Data regarding COVID-19 vaccination status, symptom development, hospitalization, intubation, and death were collected.

Results: Forty-four patients (14%) were diagnosed with COVID-19, 18 (41%) of which were Delta variant. The rate of infection with Delta was 4-fold higher than with earlier strains (Figure, 0.016 vs. 0.004 cases / patient months, $p<0.001$). Fifteen (83%) patients diagnosed with Delta variant

were fully vaccinated at the time of infection (p<0.001). The rate of infection with Delta variant in vaccinated and unvaccinated individuals was similar (0.017/patient months with vaccine, 0.015/patient months without vaccine, p=0.84). The majority (>89%) of patients had respiratory symptoms in both groups. More patients with Delta variant received monoclonal antibody infusions (89% vs. 54%, p=0.021) and fewer patients with Delta variant had resolution of disease (50% vs. 92%, p<0.001). There was a trend towards greater O_2 needs with Delta variant (p=0.07). Hospitalization (38% vs. 23%), intubation (11% vs. 4%), and death (11% vs. 4%) were numerically greater with Delta variant, although not statistically significant.

Conclusion: The incidence rate of SARS-CoV-2 infection was significantly greater with Delta variant in LTx recipients, despite high prevalence of full vaccination during the Delta wave. Further study in larger cohorts is needed to determine whether booster vaccines can reduce such infectivity.



(1311)

Post Lung Transplant Rehabilitation Program During the COVID Era

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Purpose: The post lung transplant (LTx) rehabilitation program was required to rapidly reduce service provision during coronavirus (COVID 19) pandemic. This was achieved by minimising the group format, number of sessions and type of exercises performed, as it transitioned from a centre-based supervised program to a home based program. **Aim**: This retrospective study aimed to compare standardised outcome measures for LTx recipients from the non- COVID era (2019) to those from LTx recipients who completed rehabilitation at home during the COVID (2020). Study population included post LTx males & females > 18 years who underwent BSLTx or SLTx at The Alfred from March to August 2020, compared to a matched cohort transplanted between March-August in 2019.

Methods: The 2019 post LTx rehabilitation program was a thrice weekly, 8 weekly supervised, group format consisting of 30 minutes cardiovascular training on treadmill and exercise bike plus resistance training for upper and lower limbs. During 2020 (COVID) the rehabilitation program was shortened to a twice weekly, individual, 2 - 3 week format followed by a home exercise program (HEP) using exercise diary and weekly phone follow up. COVID era patients were discharged from the gym to the HEP as soon as they were safe to exercise independently. Outcome measures -six minute walk test (6MWT), grip strength (GS) on a dynamometer and a sit to stand test in one minute (STS) were taken on entry to the rehabilitation program and three months post (3/12P). Quality of life (QOL) questionnaire was completed.

Results: Groups were well matched for LTx age, surgery and length of hospital stay. After 3 months, COVID era participants had not significantly increased 6MWD compared to Non -COVID era (-183m (-230 to -137)) STS improved significantly in both Non-COVID (p=0.001) and COVID (p=0.008) . There was no improvement in QOL or GS for COVID group, but significant improvements for non-COVID QOL (p=0.001) and GS (p=0.05).

Conclusion: The change to a HEP in COVID era may have negatively impacted the improvement in functional exercise capacity, GS and QOL for those LTx recipients. Further research is required to develop an optimal HEP model.

(1312)

Effectiveness of Messenger Ribonucleic Acid Vaccine in Lung Transplant Recipients

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Purpose: Immunization is heralded as a key tool to combat the COVID-19 pandemic. One key technology, messenger RNA (mRNA) vaccines have demonstrated an efficacy greater than 94%[1,2]. While mRNA vaccines create strong protection in the majority of patients, the antibody response in solid organ recipients has been reported to be less reliable[3]. Herein, we report the incidence and mortality of COVID-19 in lung transplant recipients after receiving a messenger RNA vaccine (BNT162b2 [Pfizer-BioNTech] or mRNA1273 [Moderna]).

Methods: From February 1, 2021 to September 1, 2021, SARS-CoV-2 positivity, admissions to the hospital, and mortality among lung transplant recipients was recorded at our institution. This timeframe was selected as the mRNA vaccine became available to recipients of lung transplantation in February of 2021. To obtain the immunization status of lung transplant recipients eligible for vaccination with one of the two mRNA vaccines, a query of the electronic medical record was performed during the previously mentioned dates.

Results: Among 317 patients, 276 had received at least two doses of mRNA vaccine (87%). Twenty-six tested positive (8.2%). Of the 26 individuals who developed COVID-19, 20 (76.9%) required admission to the hospital with eight deaths (30.8%). Four deaths occurred among the 13 individuals who contracted SARS-CoV-2 despite having received a minimum of two doses of mRNA vaccine representing a 30.7% mortality. The average duration between immunization and a positive PCR result was 86 days (SD 56 days) for individuals who had received at least two doses of a vaccine.

Conclusion: Recent studies have shown that a third dose of the mRNA vaccine BNT162b2 (Pfizer-BioNTech) can augment the antibody response in solid organ transplantation recipients[4]. The immunogenicity of the mRNA vaccine in this population still remains less vigorous compared to the immunocompetent. The reduced efficacy of mRNA vaccines combined with the elevated rate of admission and mortality described above, demonstrate that vaccination alone cannot annul the impact of COVID-19 in these patients. When mask wearing, social distancing, and hand-washing fail, therapies such as casirivimab and imdevimab (REGN-COV2), neutralizing monoclonal antibodies against SARS-CoV-2 could be considered in early disease to suppress viral load[5] and protect this vulnerable population despite immunization status.

(1313)

SARS-CoV-2 Vaccination Efficacy & Safety in Lung Transplantation Recipients: A Single Centre Study

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Purpose: Solid Organ Transplant recipients (SOT) are at higher risk of SARS-CoV-2 infection. Mortality rates reported between 13 to over 30% in SOT recipients. SARS−CoV−2 vaccination may help reduce the morbidity and mortality of COVID−19 among SOT. There is paucity of literature of SARS-CoV-2 vaccination efficacy in lung transplantation recipients . The purpose of the study was 1) to evaluate SARS-CoV-2 vaccination efficacy & safety in lung transplantation recipients and 2) to assess the need for 3rd booster dose.

Methods: A retrospective study (from Jan 2021 till Oct 2021) of lung transplantation recipients receiving 2 doses of SARS-CoV-2 vaccination available in India i.e. ChAdOx1 nCoV- 19 Corona Virus Vaccine (Recombinant) or Whole-Virion Inactivated Vero Cell vaccine, was done to evaluate vaccination efficacy and safety. SARS-CoV-2 spike COVID antibodies levels were checked 4 weeks after 2nd dose of vaccination. Local and Systemic reactions to vaccination were noted