

Review article

Best practices during COVID-19 pandemic in solid organ transplant programs in Spain



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ARTICLE INFO

Keywords:

COVID-19

Organ transplantation

Multidisciplinary work

Best practices

ABSTRACT

Clinical management of transplant patients abruptly changed during the first months of COVID-19 pandemic (March to May 2020). The new situation led to very significant challenges, such as new forms of relationship between healthcare providers and patients and other professionals, design of protocols to prevent disease transmission and treatment of infected patients, management of waiting lists and of transplant programs during state/city lockdown, relevant reduction of medical training and educational activities, halt or delays of ongoing research, etc.

The two main objectives of the current report are: 1) to promote a project of best practices in transplantation taking advantage of the knowledge and experience acquired by professionals during the evolving situation of the

Abbreviations: COVID-19, Coronavirus infection disease 2019; EP, Expert Panel; ICU, Intensive Care Unit; KT, Kidney transplantation; SC, Scientific Committee; WL, Waiting list.

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<https://doi.org/10.1016/j.trre.2023.100749>

Available online 3 February 2023

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COVID-19 pandemic, both in performing their usual care activity, as well as in the adjustments taken to adapt to the clinical context, and 2) to create a document that collects these best practices, thus allowing the creation of a useful compendium for the exchange of knowledge between different Transplant Units.

The scientific committee and expert panel finally standardized 30 best practices, including for the pretransplant period ($n = 9$), peritransplant period ($n = 7$), postransplant period ($n = 8$) and training and communication ($n = 6$). Many aspects of hospitals and units networking, telematic approaches, patient care, value-based medicine, hospitalization, and outpatient visit strategies, training for novelties and communication skills were covered.

Massive vaccination has greatly improved the outcomes of the pandemic, with a decrease in severe cases requiring intensive care and a reduction in mortality. However, suboptimal responses to vaccines have been observed in transplant recipients, and health care strategic plans are necessary in these vulnerable populations. The best practices contained in this expert panel report may aid to their broader implementation.

1. Introduction

Clinical management of transplant patients abruptly changed during the first months of COVID-19 pandemics (March to May 2020). The new situation led to significant challenges, such as new forms of relationship between healthcare workers and patients, design of protocols to prevent disease transmission and treatment of infected patients, management of waiting list and of transplant programs during state/city lockdown, relevant reduction of medical training and educational activities, and halt or delays of ongoing research, etc. [1–3].

The two main objectives of the current report are 1) to promote a project of best practices in transplantation taking advantage of the knowledge and experience acquired by professionals during the evolving situation of the COVID-19 pandemic, both in performing their usual care activity, as well as in the adjustments taken to adapt to the clinical context, and 2) to create a document that collects these best practices, thus allowing the creation of a useful compendium for the exchange of knowledge between different Transplant Units.

2. Methods

The Project comprised several consecutive phases. Initially, the Project Manager (J.P.), presented to the sponsor (*Chiesi Pharmaceuticals*) the project design, the stages, and the final proposed output. Likewise, the calendar, the role of each of the participants, the number of practices to work on, and the tentative proposal of a file to collect and unify the information of the best practices were defined with the aid of *Amper-sand*, a marketing company.

The Scientific Committee (SC) was set up by the Project Manager and virtually met on May 11, 2021, to present the overall concept and design of the project, incorporate suggestions from members of SC, and define the next steps. Upon distribution of tasks, each member of the SC selected a set of specialists to take part of the expert panel (EP). The third virtual meeting was held on June 3, 2021, with the Project Manager, SC, and EP with the following aims: present the project and the objectives, select the best practices to be included in the project and make an effective distribution of work. After an exhibition in the plenary room, the participants were divided into workrooms. The distribution of the attendees in the different groups was carried out according to their expertise in solid organ transplantation.

Once the virtual workrooms were constituted, a structured brainstorming dynamic was carried out moderated by a member of the SC. Participants made unbiased spontaneous contributions, taking turns on a fluid and fruitful work sequence defined by the moderator. The attendees were then directed back to the plenary room so that the spokesperson of the SC from each group presented the general conclusions of their group. At this point, the rest of the colleagues were able to introduce new contributions to the defined work packages, which were included in situ, thus offering a more generalized point of view of the whole set of experts. After the virtual session, each of the EP members completed a standardized form with the best practice indicated, providing scientific documentation.

On July 13, 2021, a new meeting was held with the SC to review the content generated by the EP and unify the criteria of format and content of the final document. Once the information and agreements obtained at the SC meeting had been compiled, this report was drawn up, which sets out the best practices drafted by each member of the EP and reviewed by its coordinator. Fig. 1 summarizes the workflow of the methodology applied towards the development of this manuscript.

3. Results

The SC and the EP finally standardized 30 best practices (Table 1).

1. Pre-transplant (Table 3)

1. Networking with referral hospitals: first visit standardization and waiting list follow-up

In regions covering a vast geographical area, during the COVID-19 pandemic, travel was discouraged. Protocols were then set into place to avoid these displacements, as far as possible, and to carry out all the tests in their community hospital.

At the beginning of the pandemic, existing informed consent was reviewed to include information regarding the increased risks associated with the COVID-19 pandemic. Nephrologists responsible for the waiting list disseminated the revised version of the informed consent and had it returned signed by the patients, either by postal mail, or during in person visits. Most patients carried out their pretransplant workup in their referral centers. In selected cases, due to the pluripathology or other relevant clinical conditions that could influence post-transplant prognosis, a face-to-face visit was requested. Otherwise, patient was included on the waiting list when the pre-transplant workup was complete.

The kidney transplant (KT) candidates appreciated not having to travel during the peak of the pandemic. We learned that it is possible to perform most of the pre-transplant work-up of the protocol in the referral centers, avoiding unnecessary travels.

Although a best practice, a face-to-face personalized visit is still recommended prior to inclusion on the waiting list, especially in high complexity patients. We believe this decision should be performed on a patient-to-patient criteria, both due to their personal and clinical situation (limited mobility, non-provision of collective transport) and for the situation that may arise in the reference area (pandemic, change to a new hospital, etc.).

2. Pre-transplant assessment optimization: simple, decentralized with digital checklist

Pretransplant evaluation is frequently delayed upon preparations of patients for renal replacement therapy. Patients are often included in the kidney transplant waiting list several months after initiation of dialysis [4–6]. In our center, any nephrologist (chronic kidney disease, dialysis, or transplant unit) can do the pre-transplant workup and include the patient on the waiting list. Only high complexity patients require a final assessment from the transplant unit.

To improve the efficiency of the pre-transplant evaluation and increase the inclusion on the waiting list before the start of dialysis, we developed a pre-transplant evaluation module (*checklist* type) in the computer software department, including all relevant information within the process.

This checklist was developed in four phases:

1. A waiting list group was constituted including the staff members involved in the pre-transplant assessment and inclusion.
2. Within the computer application, a module was developed to control the tests that must be performed for the pre-transplant study.
3. Operational corrections and some improvements were made in the module.
4. From January 2022, the application was included in the pre-transplant workup routine.

In the module, items are marked as red for pending and green for those already performed. Within the module, users may access tests already collected and must only mark the test as *performed*. This module has considerably simplified the monitoring of the pre-transplant workup, especially, in patients changing between units within the department (i.e. from advanced chronic kidney disease to hemodialysis, or to peritoneal dialysis), providing the care nephrologist with the relevant information regarding the pre-transplant workup briefly and on a single screen.

Teamwork and simple and friendly design are essential for success. This tool can be especially useful when non-transplant hospitals perform the pre-transplant evaluation before referring the patient to the transplant center to be included on the waiting list. In this way, the transplant center could have the structured information of the patient upon the first pre-transplant visit.

3. Virtual transplant candidates committee

The usual transplant sessions, both transplant committees (inclusion of patients on the waiting list, hepatocarcinoma) and clinical sessions, are usually held in the medical office with an average attendance of 20 people, from different specialties.

We aimed to reduce the impact of the COVID-19 pandemic on the

development of transplant committees, to maintain the inclusion of patients on the list or assessment of hepatocarcinoma immediately.

The sessions were affected by the pandemic due to the restriction in the number of attendees per room. Aiming at reducing the impact of the COVID-19 pandemic on the meetings of the transplant committees, sessions were re-designed to be taken in a live online format [7,8]. Taking advantage of the technologies currently available, sessions were held telematically via Zoom® to connect the different specialists. Several technical difficulties were encountered: obsolete computers (without speaker or camera) and problems visualizing radiologic studies performed in other centers.

The results were satisfactory, in the sense that patients pending a committee to be included in the transplant list or to implement a treatment were not affected. Patients were grateful that the resolution of their problem was not delayed, as if it was with other examinations or procedures. An adequate supply of computers, as well as the licenses of a program for sharing radiological images and the patient medical record are essential for this purpose.

4. Virtual first visit for transplant candidates

The evaluation of a KT candidate [9] at the transplant center, often different from the site of regular nephrology care, is a challenge. We had previously aimed to improve our specific protocol with one dedicated nephrologist in a weekly consultation. At first visits, the nephrologist informed on risks and benefits of KT, collected medical data, availability of living donors and established priorities. Thereafter, the recipient performed complementary tests/visits up to a final visit with urologists and nephrologists for final acceptance for transplantation.

KT candidates with available living donors diverted to a specific circuit which, to minimize visits for the donor, we concentrated on one day the interview with the transplant nurse (informative, anamnesis and physical evaluation), the basic study (analytical and abdominal ultrasound) and the medical visit (anamnesis, physical evaluation and information on risks and benefits without analytical results). This strategy constituted an organizational endeavor for the health staff and intense effort for potential donors and recipients.

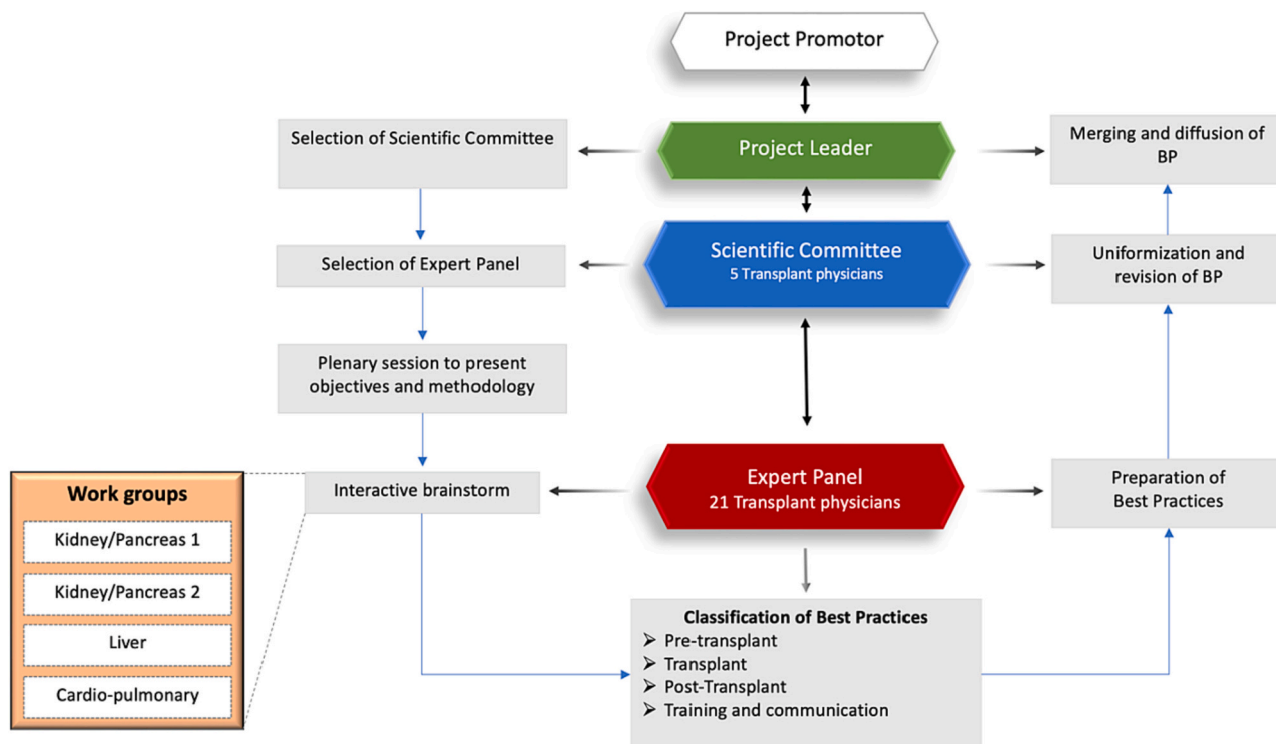


Fig. 1. Methodological flow to develop the Best Practices report.

Table 1
Best practices promoted during COVID-19 in solid organ transplant programs in Spain.

I. Pretransplant
1. Networking with referral hospitals: first visit standardization and waiting list follow-up
2. Pre-transplant assessment optimization: simple, decentralized with digital checklist
3. Virtual transplant candidates committee
4. Virtual first visit for transplant candidates
5. Communication between specialists and multidisciplinary network within the hospital
6. Extension and update of informed consent
7. Pretransplant functional pre-habilitation
8. Value-based medicine and patient perceptions in transplant programs
9. Management of massive vaccination among transplant recipients
II. Transplant
10. Check-list verification for lung transplant recipients
11. Management of the access of family and companions to the hospital during admission
12. Creation of a specialized infection unit focused on organ transplant patients
13. Reserved hospital beds for transplant recipients
14. Early discharge in liver transplant recipients
15. Early discharge in kidney transplant recipients
16. Coordination among the different transplant units
III. Posttransplant
17. Follow-up in the kidney transplant recipient: telemedicine and criteria for presential visits
18. Shared follow-up between the transplant center and the referral center
19. Patient management guidelines for shared care with primary physicians
20. Decentralized analytical work-up: sample drawing near home
21. Continuity in the treatment plan in organ transplantation
22. Outpatient biopsies
23. Functional posttransplant rehabilitation
24. Home-based drug delivery
IV. Training and communication
25. Continuous adaptation of COVID-19 management protocols
26. Continuous training for transplant professionals
27. Patient training in self-care and alarm signs detection
28. Participation in multicenter trials for COVID-19 patients
29. Implication of patient associations as a communication channel with transplant recipients
30. Medical care humanization

Table 2
A proposal for telematics and face-to-face visits for renal allograft recipients.

<ul style="list-style-type: none"> • Very stable (visits every 6 months): 1 face-to-face and 1 telematics per year • Stable (visits every 4 months): 1 face-to-face and 2 telematic per year • Stable (visits every 3 months): 2 face-to-face and 2 telematic per year (or 1 and 3) • Stable (visits every 2 months): 3 face-to-face and 3 telematic per year (or 2 and 4) • Newly transplanted: face-to-face. If it is punctual control (levels, serum Cr), telematics • Patients in the cases described as “face-to-face” previously: face-to-face
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We re-structured the first approach to the KT candidate with two visits:

- First virtual revision of patients’ clinical history and protocolized phone interview by the transplant nurse (disease background, anthropometrics, blood group and availability of living donors), whereas providing initial information of the study process.
- Face-to-face assessment by the transplant nurse and nephrologist in an *express circuit* if the study is complete with tests coordinated by the primary nephrologist followed by second joint visit with urologists within 1 month for inclusion in the waiting-list; or a *standard circuit* with a planning workup and specialists’ visits, if necessary, and final nephro-urological visit.

The evaluation of potential donors followed a similar schema:

- Virtual review of donor clinical history and phone interview by the nurse, complemented by a virtual review by the nephrologist if potential contraindications are identified. On site, first face-to-face nursing visit together with lab tests and an abdominal ultrasound. Second face-to-face visit with the nephrologist for full anamnesis and inform donor and recipient on risks and benefits of donation and transplantation adapted to their personal history. A design of the study plan from that moment, if intention to donate is confirmed [10].

5. Communication between specialists and multidisciplinary network within the hospital

The creation of the virtual multidisciplinary consultation was implemented to facilitate the assessment of patients for inclusion on the waiting list during the pandemic period. A case manager from the transplant unit receives referrals for the evaluation for KT from nephrologists of different units (i.e. advanced renal disease consults; dialysis centers) [9]. The nephrologist responsible for the waiting list makes a first virtual assessment of these patients and selects those who require face-to-face assessment, being referred to the consultations enabled for it. Patients who do not require face-to-face visit (the majority) are evaluated by the specialist virtually in a weekly multidisciplinary consultation.

With this practice, there was a reduction in the waiting time for the assessment of patients on the waiting list for KT, and in the number of consultations required prior to inclusion on the waiting list. Another accomplishment has been a response in real time to the patient’s care nephrologist. Widespread implementation of telemedicine services with the creation of the multidisciplinary consultation combined with face-to-face medicine according to patient needs, has allowed maintaining access to the waiting list for KT. The results obtained with the implementation of the multidisciplinary virtual consultation have been so satisfactory both for the patient and for the different professionals involved, that it will be maintained as part of the pre-transplant assessment for all those patients who do not require a face-to-face consultation.

6. Extension and update of informed consent

In Spain, many transplant programs were suspended during the first wave of COVID-19 pandemics (March to May 2020). Subsequently, there was a need to expand or amend the information documents and to produce new documents to transmit to patients truthful information [2].

Firstly, in the existing informed consent we included information about the risks associated with COVID-19, such the worse clinical outcome in transplant recipients with this disease. The annexes were general and procedurally specific: annex to informed consent with surgical and interventional procedures during the COVID-19 pandemic and a specific remark regarding immunosuppression. The general consent was signed at the time of evaluation for transplantation and the specific consent at the time of admission for transplantation.

Secondly, we prepared own documents such as support for teleworking:

This patient has high immune risk. As with other respiratory viral infections such as influenza, immunocompromised patients, or those with debilitating or elderly chronic illnesses, may face a higher risk of infections (and, eventually, complications) than the rest of the population. It is desirable, therefore, that immunocompromised patients be especially careful to avoid multiple contacts and hygiene. It will avoid crowds and multiple contacts. SARS-Cov-2 is a coronavirus that is transmitted by air through the droplets of saliva that are emitted when talking, coughing, or sneezing, which serve as transport for microorganisms found in the airways, but also by shaking hands with a sick person or touching a contaminated surface. This coronavirus causes a respiratory infection called COVID-19.

Now we are in a global pandemic, so the risk of infection is very high. Teleworking is recommended in these patients while we are in a pandemic.

Furthermore, following the guidelines promoted by our health authority for the vaccination for COVID-19, patients were provided with the document of the Spanish Society of Nephrology: *Vaccination recommendations for patients on renal replacement therapy* [11].

7. Pretransplant functional pre-habilitation

Patients with end-stage heart failure have high rates of frailty, malnutrition and low functional capacity. Frail patients have worse post-transplant survival, with longer admissions, more perioperative complications: requiring more days of intubation, more risk of infection, delayed healing, and lower post-transplant quality of life [12]. Cardiac rehabilitation improves the prognosis of heart failure, with a 30% reduction in the number of readmissions [13] so it has a class I

indication in the recent guidelines for cardiovascular prevention [14] and heart failure [15]. Despite this, cardiac rehabilitation programs are not well established.

Our objective was to launch a cardiac pre-habilitation program for patients on the heart transplantation (HT) waiting list, evaluating feasibility, safety, and results. A multidisciplinary team composed of anesthesia, cardiology, rehabilitation, nutrition and psychology was coordinated. All patients listed for HT were included in the program. Exercise capacity measured by oxygen consumption, muscle strength and quality of life were recorded at the beginning and two months after inclusion. In addition, post-transplant outcomes were compared to a historic cohort.

Forty patients were included as of July 2021. No adverse events were registered. Oxygen consumption, muscle strength and quality of life significantly improved after two months [16]. Four patients were

Table 3
Pre-transplant Best Practices details.

Pre-transplant Best Practice	Objective	Methodology	Results	Required resources
1. Networking with reference hospitals: first visit standardization and waiting list follow-up	<ul style="list-style-type: none"> Reduce patient displacements Avoid contact with other patients 	<ul style="list-style-type: none"> Informed consent by mail. Pre-transplant workup exams performed at community hospital 	<ul style="list-style-type: none"> Maintenance of patient inclusion on WL for transplantation. Updated follow-up of patients included on the WL 	<ul style="list-style-type: none"> Collaboration from referral hospitals/ community centers.
2. Pre-transplant assessment optimization: simple, decentralized with digital checklist	<ul style="list-style-type: none"> Improve the efficiency of the pre-transplant study. Reduce time to inclusion on WL. Increase % of patients included pre-dialysis 	<ul style="list-style-type: none"> Establish a WL group Standardized a pre-transplant checklist within hospital software 	<ul style="list-style-type: none"> Simplified monitoring of patient status on WL Updated information 	<ul style="list-style-type: none"> Versatility of hospital software
3. Virtual transplant candidates committee	<ul style="list-style-type: none"> Maintain inclusion on the WL 	<ul style="list-style-type: none"> Telematic multidisciplinary sessions 	<ul style="list-style-type: none"> Maintenance of patient inclusion for transplantation 	<ul style="list-style-type: none"> Access to internet Access to computer with microphone and camera
4. Virtual first visit for transplant candidates	<ul style="list-style-type: none"> Improve efficiency in the study process of the KT candidate and the potential living donor in a deliberative way 	<ul style="list-style-type: none"> Decentralize pre-transplant workup between health professionals (nurse and MD) Telematic first visit 	<ul style="list-style-type: none"> Virtual and telephone first visit/screening of KT candidates and potential donors Successive face-to-face visit for WL inclusion 	<ul style="list-style-type: none"> Transplant nurse (case manager) Shared digital clinical history in the health system
5. Communication between specialists and multidisciplinary network within the hospital	<ul style="list-style-type: none"> Reduce time to inclusion on WL. 	<ul style="list-style-type: none"> Telematic multidisciplinary specialist 	<ul style="list-style-type: none"> Reduce face-to-face consultation with specialist. Multidisciplinary consultation 	<ul style="list-style-type: none"> Case manager Access to internet Collaboration specialist
6. Extension and update of informed consent	<ul style="list-style-type: none"> Update informed consent to include SARS-CoV2 risks 	<ul style="list-style-type: none"> Elaborate updated informed consent, including Risk of complications Challenges in post-transplant management Changes in surgical procedures 	<ul style="list-style-type: none"> Patients truthfully informed Maintenance of active transplant program Teleworking 	<ul style="list-style-type: none"> Continuous awareness on official recommendations
7. Pretransplant functional pre-habilitation	<ul style="list-style-type: none"> Launch a cardiac pre-habilitation program for patients on the heart transplant waiting list 	<ul style="list-style-type: none"> Multimodal training program for the patient for 2 months Follow-up with reinforcement of the program until transplant 	<ul style="list-style-type: none"> Functional capacity improved significantly Improvement in quality of life and anxiety Better post-transplant evolution Fewer days of ICU admission Lower rate of medical complications Positive patient evaluation Reduced pre-transplant workup to 2-3 consecutive days 	<ul style="list-style-type: none"> Funding Multidisciplinary team Equipment and monitoring devices
8. Value-based medicine and patient perceptions in transplant programs	<ul style="list-style-type: none"> Explore, identify alternatives, and experiment new proposals for patient experience improvement 	<ul style="list-style-type: none"> Train health care workers on patient experience Focus groups with patients Interviews to patients Identify critical points Design new proposals Identification of patients on the WL 	<ul style="list-style-type: none"> Hotel-hospitalization Patient-navigator Patient-information 	<ul style="list-style-type: none"> Case manager Multidisciplinary team Volunteers
9. Management of massive vaccination among transplant recipients	<ul style="list-style-type: none"> Prioritize SARS-CoV2 vaccination for patients on the WL 	<ul style="list-style-type: none"> Communication between Preventive Medicine and Transplant Unit Vaccination at time of inclusion on the WL 	<ul style="list-style-type: none"> All patients on the WL achieved vaccination All patients received at least 2 doses 	<ul style="list-style-type: none"> Communication channels between Preventive Medicine and Transplant Unit

Abbreviations: WL, Waiting list; KT, Kidney transplantation.

removed from the transplant list due to functional improvement. Thirty-one patients were eventually transplanted. Compared with the historical cohort, prehabilitated patients had shorter intubation time and ICU admission, lower rate of medical complications and lower post-transplant rehabilitation facility requirement.

The program was highly valued by the patients and the treating team and proved to be safe and effective. Standardization of protocols and reimbursement remain a challenge for the future.

8. Value-based medicine and patient experience in transplant programs

Patient experience adds value to health care services. Our objectives were to explore, identify alternatives, and experiment new proposals for improvement of the patient experience in an established kidney-pancreas transplant program [17]. To evaluate the complete patient journey required the active participation of patients in the procedures to be implemented by the Transplant Unit, in interactive and iterative processes of communication and continuous assessment. Patients and a multidisciplinary team of healthcare workers (including doctors, nurses, administrators, a nutritionist, and a social worker) were involved over a period of 6 months. The quality process comprised several phases:

- 1) **Understand:** a) the professional perspective (clinical practice, literature review) and the patient's perspective (own experience, suggestions); b) training sessions for health professionals; c) designing of concept maps: patient journey (from referral to post-transplant follow-up), stakeholder map (all people, services, associations, and companies, involved), and archetypes of patients; d) patient interviews; e) focus groups (including patients of the different archetypes); f) patient surveys.
- 2) **Explore:** Professionals interpreted the information provided by patients and identified pivotal areas requiring improvement and unmet needs. These were discussed with patients in focus groups, and their inputs incorporated to the final proposal.
- 3) **Experiment:** implementation of proposals
 - Pre-transplant case manager who reduced kidney-pancreas pre-transplant workup to 2–3 consecutive days for patients from outside the province.
 - Hotel-hospitalization during pre-transplant assessment for patients from outside the province.
 - Patient-navigator for patients contacting with the hospital for the first time, accompanying them to the different hospital appointments during pre-transplant workup.
- 4) **Patient information:** a set of informative videos have been developed on the different stages of transplantation [18].
- 5) **Evaluate:** defined quality of life indicators that are relevant for patients and measures of patient-reported experience.

These measures reduced the time for inclusion on the waiting list from 8 months in 2018 to 2 months in 2021 and the number of patient displacements in 45% [17]. Subjectively, the information received by patients before the first visit led to a higher level of understanding.

9. Management of massive vaccination among transplant recipients

Due to the lower efficacy of SARS-CoV-2 vaccination in immunocompromised patients, it seems logical to prioritize the vaccination of patients on the waiting list for transplantation, aiming at achieving an adequate immune response prior to the transplant procedure and the immunosuppressive treatment that it entails. However, access to vaccines may not be uniform across regions, and the possibility of transplantation may arise during the immunization schedule, and transplant should not be delayed because vaccination has not been completed [19,20].

In this context it seems reasonable to centralize vaccination in reference hospital centers where the unit responsible for their follow-up is located. Our objective was to achieve adequate administration of vaccination against SARS-CoV-2 in patients on the HT waiting list.

The Regional Transplant Coordination organization provided the hospital's Preventive Medicine Unit a list of patients awaiting HT in the region in March 2021. Preventive Medicine Unit proceeded to the start of vaccination for SARS-CoV2 at the time of inclusion in the list, as well as to all those already included in the waiting list. If the transplant was performed between the two doses of the immunization schedule, it was decided to administer the second dose 2 months after the surgical procedure, if the patient had not received treatment against rejection. In October 2021, it was decided to administer a third dose against SARS-CoV-2 to all patients on the waiting list to ensure proper immunization. In those patients who were transplanted having received two doses before the transplant, a third booster dose was also administered from the first month of the transplant.

The centralization of the vaccination of patients who are candidates for HT allowed adequate communication between the doctors of the HT and Preventive Medicine Unit to guarantee an adequate vaccination schedule, and in only three patients, the transplant was performed within the immunization schedule.

II. Transplant (Table 4)

10. Check-list verification for lung transplant recipients

The progressive incorporation of pulmonologists to the lung transplant program, together with some deficiencies detected in the preparation of the candidate who faces a possible transplant, made us develop a checklist with 23 questions (yes/no) that had to be fulfilled to prepare the recipient for lung transplant surgery. They included: bed reservation, admission chart fulfilled, patient identification, clinical chart printed, triple signed informed consent –for surgery, transfusion, and COVID-19 diagnosis-, fasting, nurse orders, analytics, pregnancy test, crossmatch samples, SARS-Cov-2 PCR, electrocardiogram, thorax X-Ray, vital constants, microbiological survey, allergies, antibiotic prophylaxis, compression stockings, oxygen disposal and immunosuppressive induction treatment. The continuous revision of this list has allowed incorporating data not taken into account in the initial version.

Our aim was to provide a tool that facilitates the preparation of the candidate who enters for transplantation to the new staff of the Unit and eliminate variability in attendance by avoiding errors or omissions in the preparation of the candidate entering for a lung transplant [21].

The list specifies the documents that must accompany the patient's medical history when the patient goes down to the operating room. It also highlights foci of interest for the different doctors involved in the process (anesthesiologists, intensivists, etc.), such as allergy checking or microbiological isolations.

An initial check-list was elaborated that served as a matrix on which to add or modify the different items after their review by all the pulmonologists who at that time participated in the program. Successive revisions have slightly modified the initial document. During the COVID-19 pandemics, a second list was added with clinical and epidemiological questions aimed at assessing whether the patient was suffering at that time from an active infection by the virus, checking symptoms and positive contacts.

We have not detected the absence of relevant information for lung transplant surgery since the launch of the check-list. This tool minimizes interindividual variability in the medical care provided.

11. Management of the access of family and companions to the hospital during admission

Performing a KT is an important emotional burden for patients and their family environment. When the "call" to a patient arises, a heterogeneous circuit is set in motion, and the transplant candidate usually arrives accompanied by several family members.

Because of the COVID-19 pandemic, each hospital implemented specific measures. Most of them were related to mobility, use of hygienic measures, safe distance, etc. Regarding transplantation, no specific recommendations were made for companions of the recipient. Some

Table 4
Transplant Best Practices details.

Transplant Best Practice	Objective	Methodology	Results	Required resources
10. Checklist verification for lung transplant recipients	- Having a tool that facilitates the preparation of the candidate for lung transplantation and eliminates the variability in medical practice	- A checklist with 23 questions whose response must be "yes" before taking the patient to the operating room	- An audit shows that in all cases the checklist was completed since its implementation	- Knowledge of the checklist and its application by the pneumonologist of the lung transplant team
11. Management of the access family and companions to the hospital during admission	- Management of family and companions' access to the hospital during admission	- Provide information the measures to be applied to allow access to companions	- Absence of nosocomial COVID-19 infection from march 2020 to May 2021 in 133 kidney transplant recipients	- Nasopharyngeal COVID-19 test to companion before kidney transplantation Multidisciplinary team Companion collaboration - Medical Manager approval
12. Creation of a specialized infection unit focused on organ transplant patients	- Improve care and treatment of COVID-19 in transplant patients	- Communication between Infectious Diseases Unit and Transplant Unit - Centralize in the referral hospital the care of COVID-19 of cardiac transplant patients.	- Improvement in survival	
13. Reserved hospital beds for transplant recipients	- Ensure the maintenance of transplant activity	- Providing a free bed to the transplant recipient	- Transplant activity was maintained	- Commitment of all the agents involved
14. Early discharge in liver transplant recipients	- Early hospital discharge post liver transplantation	- Implementation of a comprehensive pathway	- Improved results - Minimizing infectious complications	- Team work willingness - Involvement of participants (basic care team, patient and family, primary care) - Assure needs: information in the waiting list, early preparation during stay, communicate to primary care, documentantion, phone attention, easy face-to-face attention
15. Early discharge in kidney transplant recipients	- Diminish hospital stay and reduce associated complications	- Teaching the transplant candidate: process information and self-care - Design a plan to be shared by all participants	- Plan of early discharge at admission - Reduction in days of stay - Reduction of hospital associated complications	
16. Coordination among the different transplant units	- Improve coordination between centers: 1) Spoke and Hub centers to improve referral of patients with advanced heart failure 2) Reach consensus on COVID-19 management in transplant patients during the early months of the pandemic	-Identification of the interlocutors in each facility (at the referral center and at the transplant center) - Virtual meetings twice a month with referral centers and any time needed with transplant centers-according to published research	- Spoke and Hub: Improved timing of patient referral and feed-back to providers - International transplant centers: Several meetings and production of weekly recommendations of management according to new information	-Virtual meeting platform - Time expenditure

Abbreviations: KT, Kidney transplantation.

units allowed the visit and contact with a single person, the same one during the period of admission.

Once the validity of the transplanted organ was selected, we checked that the potential recipient had not had risk contacts. Once in the hospital, the corresponding preoperative and nasopharyngeal test to rule out COVID-19 was performed to the candidate, and at the same time, the companion was informed of the specific situation and a nasopharyngeal COVID-19 test was also performed. Once the negativity of both tests was verified, the transplant protocol continued.

During that time, the companion was recommended to remain isolated in the transplant recipient's room, advising strict hygiene measures with hand washing with hydro-alcoholic gel, use of a mask, safety distance, avoiding social contacts once he must travel to his/her home and using as much as possible private transport. In the case of suspected contact with patients/relatives with minimal suspicion of COVID-19, we proceeded to the non-authorization to accompany the transplant recipient.

During the period described many KT were performed and we did not find any patients with nosocomial infection in the immediate post-transplant time. We have learned that it is possible to reconcile the presence of a companion during the COVID-19 by complying with the requirements discussed here. The involvement of health care workers, especially the nephrological nursing, and the understanding and collaboration of family members and patients are essential. We believe that the benefit of being is superior to the inconvenience of going through the controls mentioned to minimize the risk.

12. Creation of a specialized infection unit focused on organ transplant patients

Transplant patients with COVID-19 show high rates of intensive care need, complications, and mortality. They need specialized diagnostic work-up and drug interactions and adverse events management [22]. Consequently, to improve care and treatment of COVID-19 in HT patients we aimed to centralize the hospitalization of these patients in reference hospital centers, where the unit responsible for their usual follow-up is located, for better communication between transplant and infectious teams and an individualized assessment of the actions in each case. HT patients repeatedly go to the reference hospital where their follow-up units are located and feel much more confident when they are cared for by the professionals who attend them on a regular basis in the context of a potentially severe situation such as COVID-19.

Within the daily meetings of the committee for evaluation of the situation of the COVID-19 pandemic of our center, the heads of the HT and the Infectious Diseases Units raised with the Medical Directorate of the hospital the need to centralize in our hospital the care of COVID-19 of HT patients. This centralization allowed an adequate communication between doctors that resulted in excellent survival results.

13. Reserved hospital beds for transplant recipients

Our aim was to ensure the maintenance of transplant activity, providing a free bed and adequate preparation, together with COVID-19 screening, to the transplant recipient. The whole hospital and the managers assume the existence of a free room in the specialty area that supports the transplant program (renal, hepatic, cardiac, pulmonary) to

allow the preparation of the patient candidate for transplant.

The management of this logistics required the conviction of the medical and nursing management that the only way, in that context, to start a regulated transplant activity required a firm commitment, isolating a room. This concession entailed a commitment on the part of the department for an agile management of the rest of the hospitalization rooms that did not diminish the response of the department. For moments of crisis, a contingency plan was established. If, for some reason, it was essential to occupy the “transplant room” and that day a possible transplant arose, the “head of hospital” had the mission of vacating that room looking for any other possibility that existed in the hospital.

The measure worked properly, and our transplant program kept its activity in an adequate range, performing the same (even higher) number of transplants than those performed in previous years.

14. Early discharge in liver transplant recipients

Our “early discharge” protocol was designed in 2012 [23] and included optimization of anesthesia, refinement in the surgical technique, minimization of transfusions, early extubation, aggressive rehabilitation (early oral nutrition and immediate ambulation), personalized immunosuppression, and adequate pain control. COVID-19 pandemics obliged to reinforce this protocol and activate earlier discharges.

1. Pre-transplant: Before listing, patient and family members meet the surgery team and are explained the process of transplantation and post-transplantation, and the need for commitment of the patient and family in recovery.
2. Anesthesia: Induction with propofol/rocuronium/fentanyl, maintenance with sevoflurane, rocuronium and remifentanyl. Fluid restriction, preoperative acute hemoextraction, reinfused upon biliary reconstruction or on demand. Intraoperative blood recovery and immediate extubation [24].
3. Surgery: Cava preservation and temporary portocaval shunt, with arterial or simultaneous reperfusion in cases with donors ≥ 70 years and all DCDs. Biliary reconstructions duct to duct without T-tube, no drains.
4. Postoperative: ICU with continuous monitoring. Oral intake approximately 4 h after arrival and perform Doppler US within 12 h. Transfer to the surgical ward within the first 24 h after surgery, after removing the arterial and high-flow venous catheters. Immediate ambulation. Blood pressure, diuresis 3 times daily, and weights daily.
5. Immunosuppression: steroids, tacrolimus with intensive pharmacokinetic monitoring and mycophenolate mofetil.
6. Patients are discharged when able to perform their daily routines, adhering to their treatment, and showing a tendency towards normalization of liver and kidney functions. They receive instructions on diet, hygiene and physical activity, and we provide them with immediate telephone assistance. Initial outpatient follow-up occurs twice a week, attended simultaneously by hepatologists, surgeons, pharmacists, and a transplant nurse. Subsequently, the follow-up is weekly, bimonthly, monthly, quarterly, individualized to the patients' needs [25,26].

The average ICU stay was 12.7 h and the average post-transplant hospital stay 4 days, which defines the early discharge group. Of the total discharges, 181 (58.8%) happened by the fourth post-transplant day. Overall survival is 87.9% at one year and 79.4% at 5 years. For the 2nd period (last 4,5 years) survival improved to 91.5% (1-year) and 87.5% (5-years).

15. Early discharge in kidney transplant recipients

Prolonged admissions do not add value to the care, but increase the risk of complications [27]. This became especially relevant during COVID-19 pandemics. Our main aim was to pursue early discharge for

KT recipients. For this, we need a care team convinced that this option brings benefits to the patient and capable of working with the patient's family and environment to achieve an early discharge with guarantees of success. In addition, the collaboration of other medical specialists potentially involved in early follow-up (especially urology, endocrinology and cardiology) is essential. We also need that the patient and the family are proactive in the care process and able to assume self-care at home, and, of course, a relationship between levels of care that favors the knowledge of the case and involves the primary care physicians and nurses in the follow-up.

To accomplish our main objective, some needs were identified: 1) information from the period prior to the transplant (study and preparation of the candidate), 2) early preparation pre-discharge with nurse and medical team [28], 3) communication of discharge by the patient, relatives or other circuits together with the intervention of the nurse liaison with primary care when the social or clinical complexity of the case applies, 4) folder with documents: telephone numbers and contact times with referent nurse, 5) treatment sheet adapted to individual needs, 6) record sheets of home controls, 7) discharge report, 8) telephone attention by daily transplant nurse or with the necessary periodicity, 9) capacity of scheduled and urgent face-to-face care with nursing staff and referring doctor assigned to the program.

Hospitalization should be a residual procedure in patient care, to be activated only if there is no alternative.

16. Coordination among the different transplant units

There is a strong need for coordination among centers in the care of advanced heart failure and HT. First, between transplant centers and referral physicians, to improve timing of visits and flow of information. Second, among the different transplant centers worldwide, to reach agreement and homogenize best practices and quality control. The COVID-19 pandemic has underscored the need of coordination at both levels, enhancing patient continuity in care and standardizing treatment protocols in times of uncertainty.

Our objectives were to improve both levels of coordination.

- Between referring centers and transplant centers in criteria for referral and subsequent follow-up (*spoke and hub model* as suggested by the Heart Failure association of the European Society of Cardiology) [29]. We identified the physicians in charge of heart failure in the different Spoke centers and we designed the implementation of a fluid communication network based on virtual meetings twice a month with three main objectives: agree on management and referrals protocols, discuss clinical cases, and provide feedback on patients with shared care between the Spoke and Hub centers. Because of this strategy, adequate referral clearly increased as did patient and professional satisfaction.

- Among transplant centers at national and international level. Through the scientific societies we created forums where experience was shared from various disciplines and parts of the world and we promoted collaborative research. We also issued consensus recommendations, especially from the Spanish Society of Cardiology [30] and from the International Society for Heart and Lung Transplantation. In the latter, a COVID-19 “Task Force” was created, with involvement of pulmonologists, cardiologists, pharmacology, infectiology, anesthesiologists and intensive care specialists. A specific folder was created on the website, where free access was given to the main publications on the topic. We held weekly meetings in which we reviewed literature, clinical experiences and updated recommendation documents according to the new knowledge in the transplant population in the context of the COVID pandemic [31].

Overall, the COVID-19 pandemic has been an opportunity to identify the need for local and global communication strategies, both in terms of research and clinical practice.

III. Posttransplant (Table 5)

17. Follow-up in the kidney transplant recipient: telemedicine and criteria for presential visits

An adaptation of the post-renal transplant review visits was made to each stage of the COVID-19 pandemic, marked by the rules dictated by the health authorities and experts' committees [32].

To establish which patients should go to physical consultation, the day before the doctor reviews each patient and decides "face-to-face" when the case meets: first consultation after an admission to Nephrology, recent transplantation (<2 months), changes in immunosuppression, advanced chronic kidney disease, progressive deterioration of graft function or alarm data and patients with a known history of poor adherence or inability to communicate by telephone.

On the day the patient performs analytics, a KT consultation full-time dedicated nurse assesses the patient and decides "face-to-face" at the express request of the patient or when skin/mucosal lesions come up or new symptoms or aggravation of existing ones or poor general condition occur. In the rest of the circumstances, the patients performed their analytics, left reports and notebooks of home control, wrote down questions or new treatments and went home. Communication was established by telephone and by sending of the report and prescriptions by ordinary mail on the same day of consultation.

Positive aspects were seen: no contagion in analytics or waiting in consultation, patients returned home earlier than in face-to-face consultations, the review was the same, but without seeing the doctor, gaining in security during the time of confinement. Negative ones were also noted [33]: the telephone interview is impersonal, and the essence of the doctor-patient relationship based on direct contact can be lost; the consultation nurse saw the daily work multiplied with coding, extractions, and request for material and sending of samples.

During the period of greatest impact of the pandemic, new and old patients assumed the organizational decisions of consultation without resistance [34]. Those who were more stable, with the longest time of post-transplant evolution and especially the furthest to the center saw in the teleconsultation a better way to assist/control their problems [35]. Patients should be selected because there is a percentage of them that may require a physical visit (Table 2).

18. Shared follow-up between the transplant center and the referral center

We aimed to improve the efficiency of post-transplant follow-up, through the creation of transplant consultations or the enhancement of existing ones in nontransplant hospitals with common strategies for transplant care, ensuring a coordinated quality follow-up and avoiding unnecessary displacement.

Several phases were accomplished:

Table 5
Post-transplant Best Practices details.

Post-transplant Best Practice	Objective	Methodology	Results	Required resources
17. Follow-up in the kidney transplant recipient: telemedicine and criteria for presential visits	- Prevent SARS-CoV2 infections among immunosuppressed patients awaiting kidney transplant consultation.	- Centralize extractions. - Daily patient evaluation for face-to-face consultation. - Establish telematic communication channel.	- No infections. - Back home earlier. - No worsening quality of care. - Security gain during confinement	- Full-time nurse. - Positive attitude of health personnel. - Material resources. - Support from health authorities.
18. Shared follow-up between the transplant center and the referral center	- Reduce patient displacements Improve the efficiency of the post-transplant follow-up - Ensure a coordinated quality follow-up	- Analysis of the previous situation to plan - Protocol for selection of patients to transfer to the referral center - Common follow-up protocol. - Training of professionals - Biological sample circuits - Continuous training plan - Periodical results evaluation and improvements incorporation	- Good coordination between centers - High involvement of the professionals becoming the transplant reference specialist for the transplant center at the nontransplant hospital - Participation of the primary care centers in the management of samples - High patient satisfaction	- Collaboration hospitals/ community centers. - Digital communication - Electronic health records shared between centers
19. Patient management guidelines for shared care with primary physicians	- Improve the knowledge of primary care physicians in relation to SARS-CoV2 infection in KT patients.	- Virtual meetings - Phone call	- Optimal for patients and health care workers - Improving the care of KT recipients and their treatment	- Access to internet - Digital platform - Mobile phone - Computer - Collaborative approach
20. Decentralized analytical work-up: sample drawing near home	- Facilitate the performance of analyses in the Primary Care centers	- Implement the blood extraction in all the health areas sharing medical history	- The results have been optimal. - Avoiding travel saves time and resources for both the user and the system.	- To share medical record with all referral hospitals
21. Continuity in the treatment plan in organ transplantation	- Avoid unnecessary visits and discontinuity of care	- Develop a healthcare network to handle similar protocols with different levels of complexity	- Improvement of perceived quality outside the transplant center	- Training of specialists from other centers at the transplant centre - Teamwork - Involvement of scientific societies
22. Outpatient biopsies	- Prevent patients from entering hospitalization floors	- A protocol was established with the head of the Day Hospital	- The results were satisfactory saving beds in hospitalization floors in situations of maximum hospital occupancy.	- Day Hospital and should be equipped with sufficient personnel
23. Functional posttransplant rehabilitation	- Improve functional recovery after heart transplant	- Identification of functional patient status posttransplant and rehabilitation needs.	- Functional improvement - Posttransplant Patient satisfaction	- Connection to available resources - Physical therapy resources
24. Home-based drug delivery	- Reduced patients displacements to the Hospital	- Telematic follow-up	- Home delivery of medication	- Logistic support

Abbreviations: KT, Kidney transplantation.

1. Analysis of the previous situation to plan: means available in the nontransplant hospitals such as digital medical history, characteristics of related departments (pharmacology, microbiology, immunology, pathology), etc.
2. Action Plan:

- Protocol for the selection of patients susceptible to transfer to the nontransplant hospitals: in general, clinical stable patients would be referred at most one year after transplantation [36,37].
- Common long-term follow-up protocol according to scientific evidence and adapted to the local characteristics [37].
- If necessary, face-to-face training of the medical and nursing professional of the nontransplant hospital in the transplant center.
- Biological sample circuits:
 - Blood and urine samples: the extraction is enhanced in the primary care center, with transfer of these to the hospital that has the appropriate services, as a priority the nontransplant hospital. The availability of common test request modules facilitates that these reach directly the nontransplant hospital and primary care center.
 - Biopsies: If there are no pathologists with experience in transplant, a circuit will be available to send samples to the transplant hospital.
- Continuous training plan: periodic online meetings for case review, protocols, and topic reviews.
- Periodically evaluate the results and incorporate improvements according to detected problems.

An adequate transfer of patients to the nontransplant hospital has been achieved with a high degree of involvement of the professionals of these centers when they felt as participants in a common project. Beyond their activity in transplant consultations, these professionals have coordinated hospitalizations, problems arising with patients on the waiting list, etc., becoming the reference for the transplant center in their hospitals.

The subjective perception of patients is positive, especially when they perceive good coordination between hospitals. The lack of a shared electronic health record may be a limitation to ensure a coordinated follow-up.

19. Patient management guidelines for shared care with primary physicians

In this pandemic, primary care physicians supported a substantial burden of the medical treatment of patients with (or suspected) SARS-CoV-2 infection, comprising diagnostic testing, identification of those in need of hospital care, doing home visits, and supporting patients who manage the disease at home [38]. In this context, we observed a lack of adequate information about how to manage KT recipients in different aspects, such as the possible complications related to this infection, drugs that could be used in case of disease or criteria for referring the KT patient to the hospital, that have usually been the subject of frequent consultation from primary care physicians.

Our objective was to improve the degree of general knowledge of primary care physicians in relation to the patient with kidney disease and, in particular, in relation to the KT patient in the context of the pandemic caused by COVID-19 [39].

We organized different virtual meetings between primary care physicians of the centers attached to our hospital and the nephrologists of the transplant team. Initially, the aim was to collect the doubts of primary care physicians regarding the management of transplant patients in these circumstances. The main topics of interest were how to manage in case of family contacts, vaccines, what to do with immunosuppressive treatment, possible complications and criteria for referral to the hospital among others. All of them were reviewed by the KT nephrologist of our department, exposing the most frequent problems and their treatments, possible complications, as well as changes in immunosuppression under certain circumstances. In addition, the criteria for consultation with the nephrologist or hospital care were reviewed, and a telephone number

was provided to resolve doubts in a quicker and direct way with the nephrologist, improving our effectiveness in the KT patient treatment.

We found a great satisfaction on the part of the primary care physicians in the attention perceived from the nephrology department, lower iatrogenic and a lower number of KT patients referred to the hospital, that could be managed at home. In our opinion, the key for the success was to offer a quick way (phone, videoconference) to collaborate with primary care physicians.

20. Decentralized analytical work-up: sample drawing near home

Our aim was to facilitate the performance of analyses in the points of blood extraction of the primary care center of each health area. It began, as a test, in the primary care center belonging to our health area. The initiative was based on an approach initiated at our department to decentralize blood draws, remove them from the hospital and move them closer to the citizen. Once the measure was established in our area and its effectiveness and safety verified, it was extended to the rest of the health areas, with hospitals, both general and regional and their respective laboratories. An additional measure was established for immunosuppressive drugs blood levels in those hospitals that do not have a level determination laboratory, through which they send us the tubes extracted with the application flyer for analysis in our center.

An application flyer must be delivered to the patient at least one week before the scheduled appointment so that they can request the extraction date where applicable. The results are accessible in <24 h, through the shared medical history, which is common for the entire region.

The results have been optimal. Only specific errors have been recorded, unrelated to decentralization. As a rule, the patient's perception of the measure implemented has been very positive. Avoiding travel saves time and resources for both the user and the system. It was possible to delegate a part of the care task of the transplant without compromising the quality or the relationship with the patients.

The key factor for success is to have an adequate computer support that allows access to the results of tests carried out in any other areas of health.

21. Continuity in the treatment plan in organ transplantation

Transplant patients frequently suffer a care gap after hospital discharge due to lack of coordination between the different health providers. This implies diagnostic and therapeutic delays that can have unfavorable repercussions on the transplant recipient and generate stress for the patient. This was most evident during the COVID pandemic. A healthcare network, that handles similar protocols and with different levels of complexity is essential for more efficient patient care throughout the transplant process, avoiding unnecessary visits and discontinuity of care [40]. It includes:

- Electronic health record (or two-way access) as far as possible. Share links with information of interest.
- Joint meetings with referral centers.
- Consensuated care protocols (referral, early and late follow-up post-transplantation) available online. Evaluation of results and consequent rethinking.
- Fast communication between centers.
- Professionals trained at the transplant center for three months.
- A reference specialist in the referral hospital is mandatory.
- To establish care pathways with primary care and different specialties.
- To create management protocols for the most prevalent post-transplant comorbidities.
- To design and implement a program of early discharges and home care.
- Use of extrahospitalary resources: nurse case manager, telemedicine, home care hospitalization, day care unit, and long-stay hospitals.

All these new practices must be notified in writing to all hospitals and heads of department for further dissemination. It also implies meetings with the different hospitals and physicians involved in the care network.

This best practice improves the quality of care perceived by the patient outside the transplant center. A key to the success is the training of specialists from other centres at the transplant centre, teamwork, and the involvement of scientific societies.

22. Outpatient biopsies

Liver biopsies were being performed on the inpatient wards. It usually mean short stays, <24 h. During pandemic, because of the lack of beds in the hospitalization floors and to minimize the risk of contagion by COVID-19 in the hospital, we considered performing liver biopsies in the day hospital [41]. Our goal was to prevent patients from entering hospitalization floors, reducing infections, and avoiding the occupation of such scarce beds at the peak of the pandemic.

A protocol was established with the head of the day hospital. The patient would arrive at the day hospital at 8.15 a.m., the admission protocol would be carried out, with intravenous channeling and preparation of material necessary for the biopsy. At 8.30 a.m. the liver biopsy would be performed, and the patient would remain under observation until 3 p.m. If there were no complications, discharge would proceed. The protocol detailed the procedure, material and personnel needed to perform the biopsy. Post-biopsy care and warning signs of complications were also documented.

The results were very satisfactory saving admission beds in hospitalization floors and allowing the procedure to be performed even in situations of maximum hospital occupancy.

Essential factors are to have hepatologists sensitized to the importance of maintaining the performance of the test despite the high hospital occupancy, to have a motivated Medical Directorate that wants to improve the efficiency of the process by avoiding unnecessary admissions, responsible and day hospital staff motivated to enhance their unit and to get the positive perception of the patient avoiding admission [42].

Many techniques could be performed in the day hospital. These units should be equipped with sufficient personnel to be able to get the most out of them.

23. Functional postransplant rehabilitation

Frailty and malnutrition are very prevalent among patients with end-stage heart failure and may worsen after HT due to admittance in critical care and the use of high-dose corticosteroids. Postransplant rehabilitation is not widely used but has shown to improve long-term outcomes and quality of life [43,44].

We designed a strategy of nutritional support and intensive physical rehabilitation in the post-transplant in coordination with the pretransplant pre-habilitation program (see best practice 7). The program consisted of addressing the three fundamental factors of rehabilitation in the post-transplant period: nutrition, emotional balance and physical recovery.

The intervention was started early, in the immediate postoperative period, through the coordination of a nutritionist and the physiotherapy team during intensive care admittance and continued throughout admission as well as at discharge.

There are four possibilities of discharge support: the most unconditioned refer to rehabilitation centers with which we work in a coordinated manner; those autonomous, who still require supervision, come to do cardiac rehabilitation at the hospital gym; those autonomous who know the program well, continue with cardiac rehabilitation through a telematic program, and those who are independent enough to be discharged home, but not to do an "on-line" class, receive physiotherapy support at home.

Patients undergoing emergent transplantation are usually in a worse post-transplant functional state and need special and proportional attention. The incorporation of physiotherapy and nutrition from the

immediate post-surgery period has improved the nutritional status of patients and has increased their autonomy in a shorter postoperative time. In addition, it has reduced the number of patients who must be discharged to a rehabilitation center and has allowed more patients to be discharged at home with home support.

24. Home-based drug delivery

Outpatient transplant patients frequently require delivery of certain medications directly from the Hospital Pharmacy Services due to specific drug characteristics that require detailed information on its dosage and administration. The Outpatient Units of the Pharmacy Services are responsible for these tasks, providing, in addition, patient counseling, surveillance and supervision.

The state of alarm caused by the SARS-CoV-2 pandemic and the subsequent confinement, limited patient mobility and, thus, the access to certain medications. For this reason, the National Health System issued a regulation aiming to specify the requirements for the supply of Hospital delivered drugs [45,46].

Madrid regional government authorized "non-face-to-face" pharmaceutical care procedures based on home drug delivery. This action guaranteed the continuity of treatments while ensuring safety and promoting adherence [47].

Telemedicine strategies (mostly phone consultations) were implemented to avoid the displacement of the patients to the medical centers that were, at that point, overwhelmed because of the pandemic.

The Pharmacy Services had to face the new situation developing strategies to guarantee delivering of medication to patients' home. In addition, they implemented "non-face-to-face" pharmaceutical counseling, providing continuity of care and ensuring patient information throughout the whole process [48]. Automated computer systems enabled the electronic medical prescription and validation of outpatient treatments. We adapted to the new situation allowing at-home drug delivery and virtual pharmaceutical care. The different outpatient medical units oversaw contacting the patients, providing information about the new process and obtaining their verbal consent.

Between April 2020 and March 2021, 31,066 deliveries of medication to 7170 patients were made. In addition, 7443 virtual pharmaceutical care consultations were performed. In a satisfaction survey, 100% of patients rated home delivery as good, and 97.6% of them considered the non-face-to-face pharmaceutical counseling also as good.

This initiative has provided significant benefits by reducing the presence of the patient at the hospital, thereby reducing the risks of infection and spread. For health-care professionals, it allowed an adequate organization of work, avoiding face-to face attendance.

IV. Training and communication (Table 6)

25. Continuous adaptation of COVID-19 management protocols

In COVID-19 pandemic, it was pertinent to consider some approaches in the KT program and have it well structured and explicit to avoid errors, since it is a process where many professionals are involved. New protocols are needed for a new situation. Our aim was to guarantee a comprehensive care of transplant patients, through protocolization of four processes:

- Organize the transplant program, in relation to implants. Discuss whether to keep it open with the potential risk of receiving an induction protocol with immunosuppressants or limit it.
- Management of immunosuppressive drugs in patients with COVID-19.
- Protocol for the care of patients in pandemics, who must continue with their treatment of narrow therapeutic range.
- Gathering practical experience in a COVID-19 registry to be able to make decisions with data.

At the time of the declaration of pandemic, daily working meeting

Table 6
Training and communication Best Practices details.

Best Practice – training and communication	Objective	Methodology	Results	Required resources
25. Continuous adaptation of COVID-19 management protocols	- Maintaining patient care and homogeneity in patient management	- Update of immunosuppression protocols in Covid-infected patients. - Protocolize clinical reviews according to the patient’s profile (frequency and face-to-face versus virtual). - Implementation of the Covid Registry.	- Decreased variability in patient care - Ensure continuity of patient care - Decrease the presence of stable patients in at-risk locations.	- Multidisciplinary team - Telephone and computer equipment with camera and microphone. - Dimensioning of human resources
26. Continuous training for transplant professionals	- Maintain multidisciplinary and transplant training meetings.	- Creation of a virtual room using the health institution’s computer servers.	- No interruption of the session program - Greater incorporation of members to the meetings	- Specific network that guarantees security and confidentiality. - Adequate technological equipment
27. Patient training in self-care and alarm signs detection	- Maintain updated information for patients	- Periodic workshops and organized sessions, held online during pandemic	- High patient satisfaction with the training and information provided	- Creation of a wide network with patient associations, health professionals and industry
28. Participation in multicenter trials for COVID-19 patients	- Validate results of factors that predict the severity of the disease, the impact of different treatments and the response to vaccination.	- Multicenter clinical studies.	- Immediate knowledge of therapeutic management, prognosis and clinical evolution.	- Medical coordinator - Collaboration hospitals - Digital communication
29. Implication of patient associations as a communication channel with transplant recipients	- Facilitate communication with patients to meet requests beyond daily clinical follow-up	- Direct channel of communication between the patient association representative and the liver transplant unit by e-mail or instant messaging	- Improved communication - Patient satisfaction	- Membership in a patient association - Instant messaging or e-mail available
30. Medical care humanization	- Establish a friendly and close contact with transplant patients	- Scheduling periodic calls to the most vulnerable patients	- Gratitude of the patients who received the telephone support	- None

was held to organize the planning and structuring patient care. Monthly the pandemic situation was evaluated to decide to keep closed or open the transplant program.

Once the program was opened with a specific protocol, every three months the protocol was reviewed in a pandemic situation, in relation to the occupation of the hospital, characteristics of the donors and recipients.

A protocol for the management of immunosuppressive drugs in the case of COVID-19 infection was drafted, the collection of data on COVID-19 cases in the national registry was organized, the reassignment of clinical and analytical evaluation of patients began to be organized in a personalized way and teleconsultation to be used.

The team gained enormous knowledge on the profile and risk factors for complications of transplant patients, the risk of mortality, impact of the management of immunosuppressants during COVID-19 on the end-organ function. With the structured work and with the action in accordance with the protocols issued, it was been possible to evaluate the results and make decisions.

26. Continuous training for transplant professionals

In the context of the COVID-19 pandemic, hospitals saw the usual face-to-face multidisciplinary medical sessions suspended. However, that same period required that constant training and updating continue, due to the constant changes in clinical practice as new results and information on COVID-19 were obtained. Thus, alternatives to face-to-face sessions had to be proposed, not only to cover this great need for continuous training, but also to ensure good coordination and communication between professionals.

Our aim was to maintain the training and communication of the teams of our liver transplant unit during the pandemic. To this end, we sought a system that would allow clinical sessions to be held telematically, through the institution’s own computer servers, and to establish a program that would combine both, training sessions, where the latest COVID-19-related updates are included, and traditional clinical meetings. The heads of departments and the hospital director managed to obtain from our regional Health Service the provision of a virtual room in the institutional network that would guarantee the necessary security

and confidentiality requirements. A calendar of sessions was drawn up and a circular was sent with all the necessary information to be able to access the channel to all involved professionals.

The initiative allowed to keep the teams connected and carrying out continuous quality training in a context of great need for medical updating and constant communication. At present, this tool has been preserved and is very useful for the entire department. The clinical sessions continue to be systematically retransmitted so that the staff who cannot go in person at that time have the opportunity to follow them telematically.

The need to implement this measure favored the predisposition and acceptance by all the actors involved [48,49]. In addition, this format allows specialists from other centers to join the meetings to discuss difficult cases and thus improve training and quality of care. The equipment available in the hospital can be a relevant factor for participation, as these must be provided with the technical requirements that ensure good connectivity.

27. Patient training in self-care and alarm signs detection

Patient associations and transplant professionals have created for years spaces for participation and exchange of experiences. This facilitates training in diagnostic and therapeutic aspects of disease, and at the same time promotes the approach between the doctor and the patient. In organized sessions, doubts about their disease are informed, guided and resolved, covering all their spheres and how the disease could affect their quality of life. Workshops/conferences have been organized at the initiative of the transplant unit, with the active participation of patient associations and the citizenship care section of the Hospital Management.

We have organized periodic workshops designed for and with patients. Health professionals, patient associations and industry, were united with the same goal: to be the voice of all those who have something to say, communicate and share. This half-day activity (in-person and online; only online during pandemics) consists of two general and transversal sessions at the assembly hall of 45 min duration with time for questions: 1) *How to protect ourselves against infections* (precautions we must have before everyday things: travel, vaccinations, pets, food, and

warning signs of possible opportunistic infection) and 2) *Life with immunosuppressants*. (Information that will help you know to avoid risks and useful tips, the role of the pharmacist intra and out of hospital, basic concepts, levels, side effects, interactions, etc., and warning signs of rejection). Afterwards, 1-h specific simultaneous organ workshops (psychosocial aspects, management of special devices, specific problems of each transplanted organ, such as warning signs that suggest rejection, follow-up... and questions from transplant patients and their families) are held in classrooms.

The patient knows better the evolution of the process, both pre-transplant, peri-transplant, and post-transplantation. Being in a familiar environment, it is easier asking questions and doubts. The patients see other transplant recipients with different experiences that could help him to understand the long process of transplantation. They are informed about new therapies, research projects, organization of care, what to do in unexpected health situations, etc.

Due to the COVID-19 pandemic, the 2020 and 2021 workshops were cancelled, and training videos were planned. Given the situation, they were shared online through digital platforms and, subsequently, posted on the websites of both patient associations and scientific societies and transplant units.

28. Participation in multicenter trials for COVID-19 patients

During COVID-19 pandemic, it was necessary to create knowledge. Our goal was to devise a way to maintain multicenter studies to quickly and validly find the factors that predict the severity of the disease, the impact of different treatments, and the response to vaccination.

Multicenter studies were a valid tool to obtain rapid and robust information on diagnosis, response to different treatments at any stage of the disease, predictors of severity and mortality. This type of study in COVID-19 patients gives the possibility of recruiting a larger population of subjects in a more open range of clinical settings, thus presenting an experimental situation that is more representative for future use. The involvement of several researchers also offers the potential for a wider point of view of this new disease.

It was essential to have one or two central coordinators who designed common protocols and made all the activities of the study efficient. Variation in evaluation criteria and schemes could be reduced by organizing investigator meetings, training clinical study staff in advance, and conducting meticulous supervision during the study.

The results obtained with this initiative in COVID-19 patients have been a great success, since the results have been communicated to the scientific community through publications in high-impact journals and, in turn, this communication has undoubtedly been the key to the success achieved. The knowledge acquired through these multicenter studies had a direct impact on the therapeutic management, prognosis, and evolution of patients with COVID-19 infection. Therefore, the perception of the quality of care of patients is directly related to the measures implemented in the conduct of this type of study.

29. Implication of patient associations as a communication channel with transplant recipients

We aimed to establish a channel of communication with patients to keep them informed in relation to any aspect relevant to them, whether associated with the COVID-19 pandemic or any other type of information in relation to the transplanted organ [50]. Given the isolation situation caused by COVID-19, from the liver transplant unit of the hospital it was decided to contact, directly, with patient association representatives. Fluid communication started between the hepatologists and the president of the association by both email and WhatsApp, in a single channel. A 1:1 communication was established with the aim of achieving an agile and direct communication.

Through this hospital-association channel, patients began to be informed of the new guidelines that were appearing, as well as any relevant health update for the liver transplant patient [51].

The possibility of having a doctor-patient communication channel

through the association has been positively valued by those that were involved. It gave patients the opportunity to obtain information directly from the health team and, in turn, allowed the health team to understand patients' concerns during the pandemic.

The biggest limitation is the time available of the medical staff for doing activities outside clinical practice itself. However, this initiative has based much of its success precisely on the economization of the time invested by each patient, since thanks to the work of the association it is possible to respond to many of them at the same time. Another condition that can have a greater impact in other areas is the fact that not all patients are part of the patient association(s), which can limit the success of the results.

30. Medical care humanization

Technological advances and changes in the provision of the health service have increased the distance between the patient and the doctor. In addition, many professionals prefer to comply with their part of the diagnosis or treatment, without getting involved or committing themselves personally. In this way there is a fragmentation of patient care that certainly does not benefit the patient. Therefore, and in a generic way, humanization in medical care is characterized by a set of practices aimed at achieving better care and greater patient care. The moment we lived, during the outbreak of the pandemic, was especially difficult for transplant patients. In addition, it was very difficult during the lockdown. Patients with less than a year of transplantation and, to a lesser extent, the most veterans, were away for several months from hospital centers. Doctors would attend to their symptoms by phone, evaluate what they told us, and make decisions and advise treatments. It was in this daily work of telephone attention where we could perceive the fear that the patients felt and the comfort that our calls produced to them.

The concept of humanizing includes the relationship with the other, sharing a community and empathic, kind contact. The time we experienced during the initial phase of the pandemic was especially difficult for transplant patients. Following the observations, we wanted to establish a friendly and close contact with our transplant patients.

The practice consisted of scheduling periodic calls to the most vulnerable patients, more emotionally fragile and/or with less family support. The result has been the gratitude of the patients who received the telephone support to clarify doubts, help them with the treatment and reassure them about the situation we were all experiencing. Patients' own satisfaction can be considered a good indicator, even if it is not evaluated with measurable parameters, as it allows us to know if the initiative is being well received.

4. Discussion

The new situation during the COVID-19 pandemics led to significant challenges, such as new forms of relationship between healthcare providers and patients, design of protocols for transmission protection and management, protocols for transplant program lockdown and waiting list management, reduction of medical training and educational activities and slowing down in research development.

All transplant units needed to adapt their operations to the new situation and new scenario, characterized by a high uncertainty, absence of similar experiences, impossibility of proposal testing and all these factors in the context of healthcare top pressure. The adaptation of the transplant unit in the way of caring for patients has been different in each center. New or modified procedures and new methodologies/technologies in care processes have been incorporated for the clinical care of patients. Possibility of access, difficulty, or limitations for the implementation of these new methodologies/technologies, and acceptance/adaptation by professionals and patients have shown a wide variety [52].

The introduction of these recent care changes can have certain consequences:

1. A broad, pragmatic, diverse, fragmented, decentralized, non-protocolized and unevaluated learning has been generated in a relatively short period by all the professionals who have necessarily participated in the process in each transplant unit.
2. Each professional who has participated in each of the new experiences to adapt the care model has a very clear idea of the advantages/disadvantages of each aspect in which their care work has been modified, as well as the difficulties for its implementation.
3. The experiences lived by each professional and by each transplant unit have been very diverse and heterogeneous.
4. The experience acquired has a value beyond the current moment, since they respond to changes that will be established to a greater or lesser extent.

Everything described above can generate an opportunity for all professionals, patients, and the health system itself, which would be more than interesting if it could be shared to take advantage of all this learning acquired.

Funding

This Project was funded by an unrestricted grant from Chiesi Pharmaceuticals. Ampersand Consulting was also involved as a methodological advisor.

Disclosures

The authors do not express any disclosure related to the content of this manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors express their gratitude to all the transplant staff, physicians and nurses who took care of transplant donors and recipients during the pandemics and developed best practices in daily care.

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