



# Analysis of impact on tissue activity during COVID-19 outbreak: a survey of 8 banks in Spain

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**Abstract** On March 19 World Health Organization declare the pandemic situation by outbreak coronavirus disease 2019 in the world. The pressure on the health care system has been very high in several countries. Spanish National Transplant Organization (ONT) have made many efforts in maintaining transplantation activity. Although the impact of the pandemic on organ activity has been analysed, to date, less data exist regarding the impact on tissue activity. The aim of this study has been the evaluation

of the possible impact on the procurement, processing and distribution of tissues during the peak period of the pandemic COVID-19 in Spain. For this study, a multicentre analysis has been made with a survey of the tissue banks in Spain, during the period March 1 to April 30, 2020. Our data suggest that the impact of coronavirus in Spain has affected dramatically tissue donation but with a moderate effect on stored tissues such as bone, valves, vessels or skin. Tissue banks should prepare if future next pandemic waves surges

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so that tissue provision is guaranteed both in urgent and elective surgeries.

**Keywords** Tissue bank · COVID-19 · Spain · Pandemic period · Outbreak

## Introduction

At the end of December 2019, Chinese public health authorities reported several cases of acute respiratory syndrome in Wuhan City, Hubei province, China (Chen et al. 2020). Chinese scientists soon identified a novel coronavirus as the main causative agent (Zhun et al. 2020). The disease is now referred to as coronavirus disease 2019 (COVID-19), and the causative virus is called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Zhou et al. 2020), it is a new strain of coronavirus that has not been previously identified in humans. COVID-19 is an illness characterised by respiratory symptoms, including coughing, breathlessness, and fever. Its full pathogenesis remains unknown but individuals with certain underlying chronic conditions, the elderly and immunocompromised individuals are at greater risk (Guan et al. 2020).

The initial outbreak in Wuhan spread rapidly, affecting other parts of China. Cases were soon detected in several other countries. Outbreaks and clusters of the disease have been observed in Asia, Europe, Australia, Africa and the Americas.

On March 19 World Health Organization (WHO) declare the pandemic situation. The pressure on the health care system is very high in several countries and increasing numbers of infected health care staff are being reported. Many European countries have imposed major restrictions on meetings, travel and everyday life.

Spain has been one of the first countries dealing with the outbreak of COVID-19 and severe measures have been adopted to limit viral transmission. The first Spanish case was detected in a German citizen in La Gomera island on January 31st. Thereafter, infected patient number have grown at an exponential rate spreading to all Spanish regions, becoming one of the most affected countries in the world. Drastic emergency restrictions including quarantine and strict self-isolation measures were established.

Human tissues for transplantation represent one of the best treatment alternatives in many clinical circumstances. Maintaining their activity, ensuring their safety, should represent a goal for Health Services.

Although there is no evidence, recommendations concerning the screening of donors of human tissue and cells have been released as the potential for transmission of COVID-19 through transplant.

The US Food and Drug Administration has suggested considering a donors' history of travel to areas of outbreak, cohabitation with infected individuals, or diagnosis or suspicion of COVID-19 within the 28 days before recovery of donor tissue. Similar measures have been taken by the Global Alliance of Eye Bank Association and by the Joint United Kingdom Blood Transfusion Service Professional Advisory Committee to rule out potential donor. The European Society for Blood and Marrow Transplantation has recommended excluding potential donors who have been diagnosed with COVID-19 and waiting at least 21 days before donation in those with a history of high-risk travel or contact. In Italy, the National Transplant Centre recommended testing all potential tissue and stem cell living donors, as well as dead donors through real time RT-PCR assays of nasopharyngeal swab sample or bronch alveolar lavage in deceased individuals.

In Spain, the National Transplant Organization (ONT) has taken stronger measures. From March 17, a systematic COVID-19 surveillance was imposed for deceased donors. Since then, all potential tissue donors are screened by SARS-CoV-2. In addition to this in April 24, that screening expands to potential tissue recipient patients.

Despite the efforts of the health authorities in maintaining this activity by ensuring the safety of the tissues, it is likely that we are experiencing a tremendous impact on the tissue transplant activity in Europe as many others parts of the world. The medium or long-term effects on patients requiring tissues for transplant, such as their impairment, as well the increased waiting lists, are unknown.

The aim of this study has been the evaluation of the possible impact on the activity of procurement and distribution of tissues during the peak period of the pandemic in Spain. For this study, a multicentre analysis has been made with a survey of some tissue

banks in Spain, between first of March to 30th of April 2020.

## Materials and methods

We have set up a survey of tissue activity during the period of March to April 2020 in Spain. This period was chosen for being the maximum peak of the pandemic in Spain.

Banks were asked for the number of donor, tissue processing and tissue distributed in comparison with the same period in the years 2017–2019.

Participants Tissue Establishments are included in Table 1. The number of participants is a representative sample of the tissue banks in Spain, which traditionally process and distribute a significant amount of tissue in this country.

### Statistical analysis

Correlation and linear regression were used as techniques for quantifying the association between the two numeric variables: Prevalence of infection in each region as independent variable and donor declined percentage as response variable. We calculate Pearson's correlation ( $r$ ) and Spearman's rho ( $\rho$ ) coefficients. The hypothesis test of correlation tests were considered with a linear relationship with a  $P < 0.05$ .

## Results

Results are shown on Tables 2 and 3.

During the period between 1st March to 30th April 2020 we have observed a general drop in the number of tissue donors that ranged from 33,3% in the Navarra Community to 78, 8% in the Basque Country, compared with the average number of tissue donors in the same period three years before. The average drop in number of donors has been from 55,8% in the Banks consulted.

Although there is a generalized drop in activity, very important differences between territories are appreciated. Basque Country, Aragon and Andalusia have increased bone production, with Aragon and the Basque Country also being the most demanded in the request for corneas. It highlights that the need for skin has been increased in the Valencian Community.

In general, tissue distribution has been greatly reduced because of the drop in surgical activity during the most important period of the pandemic.

## Discussion

Countries around the world are mobilizing to try to halt the coronavirus outbreak that has infected more than 3 million people and killed more than 250,000 others. Spain has been a country especially affected in number of cases by infection. On April 30, 239.639

**Table 1** Tissue establishments (TE) participants and prevalence of COVID-19 at April 30, 2020. *Source:* Instituto de Salud Carlos III. Spain

Region	EU TE code	TE name	Prevalence COVID-19 positive <sup>a</sup>
Andalusia	ES000281	Centro Regional de Transfusión Sanguínea y Banco Sectorial de Tejidos de Córdoba	152
	ES000635	Centro Regional de Transfusión Sanguínea y Banco Sectorial de Tejidos de Málaga	
Basque Country	ES000091	Centro Vasco de Transfusión Sanguínea y Tejidos humanos	640
Valencian Community	ES001219	Centro de Transfusión de la Comunidad Valenciana. Valencia	222
Aragon	ES001309	Banco de Sangre y Tejidos de Aragón. Zaragoza	408
Madrid	ES000377	Hospital Universitario de Getafe	938
Asturias	ES000791	Centro Comunitario de Sangre y Tejidos del Principado de Asturias	249
Navarra	ES008180	Banco de Sangre y Tejidos de Navarra. Pamplona	806

<sup>a</sup>Number of cases  $\times 10^5$  people

**Table 2** Number of donors received for tissue processing in Spain during the period of March 1 to April 30, 2020, compared to the average number performed in the same time frame of the last 3 years (2017–2019)

	2020 (March 1–April 30)	2017–2019 (March 1–April 30)	% variation
Andalusia	17	49.6	– 34.27
Basque Country	7	33	– 78.8
Valencia Community	5	14.6	– 65.8
Aragon	2	5.3	– 62.3
Madrid (Getafe)	1	2.3	– 56.5
Asturias	8	20	– 60
Navarra	4	6	– 33.3

patients were diagnosed in Spain, the second country in the world after US with 1.053.036 (Johns Hopkins University and Medicine). Spanish government made strict confinement measures accompanied by a range of social distancing measures, including closure of schools, universities, libraries, centres for older people, and sporting venues, and even restricting all movement that have been in place since March 14 (royal decree 463/2020 to declare a 15-day national emergency). However, from March to 14 April, the death rate in Spain was 68% higher than usual and 21,882 excess deaths occurred. Coronavirus patients were overwhelming Madrid area.

The Spanish National Health System was decentralised since 2002. Coordination is crucial in any country, but especially in Spain in which responsibility for health is assigned to 17 very diverse regions. The Health Alert and Emergency Coordination Centre (Centro de Coordinación de Alertas y Emergencias Sanitarias in Spain), created in 2004, provides a mechanism for coordination between the national and regional governments and made the direction measures during the pandemic period.

Organizational and logistical aspects are required for transplantation activities including organ, tissue and cells an activity that is very sensitive to external factors. Spanish National Transplant Organization (ONT) has made many efforts in maintaining transplantation activity by ensuring the safety of the tissues. As the Euro CDC stated “*Maintaining a safe, sufficient and accessible supply of critical and essential Substances of Human Origin (SoHO) during a pandemic is of vital interest to public health. It is therefore critical that SoHO establishments recognise the potential impact of the pandemic on the safe and sufficient supply of SoHO and adequately respond to ensure the maintenance of core services*”.

Although the impact of the pandemic on organ activity has been previously analysed (Angelico et al. 2020) so far less data is known regarding the impact on tissue activity.

Spain a country with a strong structure in the field of donation and transplantation show, on basis our results, a clear drop in the number of tissue donors obtained in the period from March 1 to April 30. We have not found differences between the drop in the number of donors and the greater or less involvement of the region by the coronavirus (Rho Spearman – 0.142 p 0.75).

Multiple factors have been able to motivate it but, as very important, a restriction in the number of Intensive Care Units (ICU) beds available for donors may influence overall donation activity similarly to what has been published regarding organ donation (Angelico et al. 2020). ICU in many Spanish regions were over 80% capacity, despite efforts to triple the number of beds available. This drop of tissue donors ranged in our study between 33, 3% in Navarra to 78, 8% in the Basque Country.

On the contrary, tissue-processing activity has continued, although at more slowly pace in Spanish TE given the circumstance that the number of units of processed bone has been increased in the TE of Basque Country, Andalusia and Aragon with respect to the average of units obtained in the same period in the previous 3 years.

Many tissues can be stored during long period and thanks to the existence of stock in them, it has been possible to answer the urgent demand that has occurred in this period such as vessels and skin. In addition to this possible tissue, scarcities have been largely mitigated by a slow in demand due to the cancellation of elective operations. Only urgent

**Table 3** Comparison of units produced and distributed from Tissue Banks in Spain during March 1 to April 30, 2020, compared to the average number performed in the same time frame of the last 3 years (2017–2019)

	2020 (March 1–April 30)		2017–2019 (March 1–April 30)		% variation	
	Units produced	Units distributed	Units produced	Units distributed	Units produced	Units distributed
<i>Bone</i>						
Andalusia	959	330	886.6	1024	+ 8	– 67.8
Basque Country	227	63	116	234.3	+ 95	– 73.1
Valencian Community	68	72	147	165.7	– 53.7	– 56.54
Aragón	60	18	50.3	77.3	+ 19	– 76.7
Madrid (Getafe)	20	21	55	52	– 63.6	– 59.6
Asturias	23	64	131	127.7	– 82.4	– 49.8
Navarra	16	12	38.3	53.7	– 58.2	– 77.7
<i>Cornea</i>						
Andalusia	42	29	104	89	– 59.6	– 67.4
Basque Country	14	22	47	36.3	– 70.2	– 39.3
Aragón	4	10	10.6	12.3	– 62.3	– 18.7
Madrid (Getafe)	2	2	1.3	1.3	+ 53	+ 53
Asturias	12	5	28	24	– 57.1	– 79.2
Navarra	8	4	12	10.3	– 33.3	– 61.2
<i>Valves</i>						
Andalusia	42	29	104	89	– 59.6	– 67.4
Valencian Community	2	0	3.3	1.6	– 39.3	– 100
<i>Vessels</i>						
Andalusía	0	3	3.7	6.3	– 100	– 52.4
Valencian Community	4	1	10.7	7.3	– 62.6	– 86.3
Asturias	0	4	7	5.7	– 100	– 29.8
<i>Skin (cm<sup>2</sup>)</i>						
Andalusía	2014	5692	10.617	22.737	– 81	– 74.9
Valencian Community	1514	3281	26.266	3.059	– 94.2	+ 7.2
Madrid (Getafe)	2000	3500	18.000	8.583	– 88.8	– 59.2

surgical interventions or medical procedures have required the use of tissue.

Cornea due to the impossibility of long-term preservation is a critical tissue. Many corneal transplant has been cancelled or postponed in Spain with the increase in the waiting list of patients. Our results shown a drop of 79,2% in Asturias or 67,4% in Andalusia compared to average transplant in the here years before. Solutions to solve the shortage of supply of cornea and treatment need to be addressed soon.

In conclusion, our data suggest that the impact of coronavirus in Spain has affected dramatically tissue donation but with a moderate effect on stored tissues such as bone, valves or skin.

To date there is no available vaccine against SARS-CoV-2 infections and no drug with proven clinical efficacy, although there are several candidates that might be effective in prevention or treatment. With more countries, planning to loosing restrictions imposed, many scientific concerned about the

potential for a resurgence of a second wave. Tissue banks should prepare if next pandemic waves surges so that tissue provision is guaranteed both in urgent and elective surgeries.

### Bias

Much of the tissue donation activity is concentrated in the first 15 days of March.

Banks such as Madrid (Getafe) present aberrant results because of their reduced processing activity.

**Authors' contribution** All authors were involved in the final approval of the article submitted and are in agreement with all the content. All the authors have participated in the design, methodology and collected data for the study.

### Compliance with ethical standards

**Human and animal rights** This article does not contain any studies with human participants or animals performed by any of the authors.

**Conflict of interest** The authors declare that they have no conflict of interest.

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