

What we have Learned during these Three Pandemic Waves

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Abstract

This article focuses towards the measures taken during the last three pandemic waves, caused by the SARS-CoV-2 virus. It highlights the adaptation both in the strategic approach and the different organizational aspects, focusing on security for patients who required surgical intervention.

Keywords: COVID-19 Pandemic; SARS-CoV-2 Infection; Safety Management; Surgery

Abbreviations

COVID-19: SARS-CoV-2 Virus; in reference to patients infected with this virus; PCR: Viral Antigen Detection for COVID-19 by polymerase chain reaction test in nasopharyngeal smear.

Background

The pandemic caused by the SARS-CoV-2 virus (hereinafter, COVID-19) since its declaration in March '20, triggered the postponement of some programmed surgical activity during each pandemic wave (in different volume) [1].

The reference population of the Healthcare Area, and the Region, as well as the Healthcare Provision have already been described [1,2]. The maximum capacity, once all the available spaces had been conditioned, were increased from 128 (in first and second pandemic waves) to 162 beds in Intensive Care Units and Surgical Resuscitation Units (hereinafter, critical beds) in the third pandemic wave, maintaining 1135 beds in the hospitalization units (hereinafter, conventional beds).

In our Region, the celebration of family and social gatherings are customary during the Christmas period, which generated “a significant increase in internal and intercommunity mobility, as well as a notable increase in social interaction” [3]. Taking into account these circumstances, the Regional Government decreed in our Region some restrictions [3]. These restrictions included the maintenance of regional confinement [4], allowing justified reasons that, on this occasion included the return to the habitual residence or family reunification. The capacity of these celebrations was also restricted to 6 people maximum. Thus, a limitation of time zones mobility by night was established from 11:00 p.m. to 7:00 a.m., except on December 24 and 31, which began from 00:30 a.m. These restrictions included that religious worships were allowed with a maximum capacity of 50%. The mandatory use of a mask, social distancing and hand hygiene were

maintained too. Moreover, mass events were suspended (burials, sports, cultural, or folkloric activities and competitions, among others), and finally, establishments of first necessity (food, fuel, or pharmacies, among others) were kept open only.

On December 18, hospital occupancy was still decreasing very slowly due to the finishing of the second pandemic wave, and our regional accumulated incidence rate was 195.3 cases per 100,000 inhabitants, while the national average was 207.3 cases, with a range between 132.1 and 322.4 cases [5].

Regarding the accumulated incidence rates in the population, hospital occupancy, and the most relevant events that have occurred during the third pandemic wave are described below (Table 1).

Aim of the Study

Having observed the different trends in hospital occupancies depending on the circumstances into each pandemic wave, the aim of this work is to review both the strategic lines and the different organizational aspects, regarding the care of patients operated on in our hospital center, in relation to those observed during the previous pandemic waves.

Week	Average of accumulated incidence rate per 100.000 inhabitants in the last 14 days	Proportion of positives in PCR test in our region (%)	Hospital occupancy for covid-19 patients in conventional beds, in number (%)	Hospital occupancy for covid-19 patients in critical beds in number (%)	Number of operating rooms scheduled morning + afternoon (average)	Events
December 11, 20						Perimeter Decree, and control of Christmas time zones [3].
December 28, 20	116.5	2.90 %	94 (8,3%)	25 (15.4%)	18,3 + 2,3	Start of vaccination campaign to people over >80 years old [6].
						Start of admission of critical patients outside the Healthcare Area [7].
						Reached the lowest Accumulated Incidence rate in the country [6]
						Progressive increase in the ratio of income (or admitted patients)/ discharge balance: +5,0 patients daily.
January 4, 21	115.4	4.20 %	85 (7,5%)	26 (16,0%)	18.3 + 2,3	-
January 11, 21	151.5	6.60 %	74 (6,5%)	25 (15,4%)	26,4 + 8,8	2.2% of the population in the Region vaccinated (the highest in the country) [8].
						Reached the third lowest Accumulated Incidence rate in the country.
						Starting of vaccination campaign to Healthcare workers.

January 18, 21	318.2	5.20 %	108 (9,5%)	26 (16,0%)	29,0 + 8,3	Maximum occupancy of critical COVID-19 patients in others centers in the Region was exhausted [7].
						Income/discharge Balance: +7,3 patients daily.
						Postponement of 12 long-stay surgical patients.
						Increasing from 1 to 3 Surgical Committee meetings per week.
						Starting of the 2 nd dose of vaccination campaign.
						Perimeter closure of 4 municipalities in the Region [9].
January 22, 21	-	7.60 %	130 (11,5%)	25 (15,4%)	29,5 + 8,3	Income/discharge Balance: +12.0 patients daily.
						Perimeter closure of 7 municipalities in the Region.
January 25, 21	412.7		158 (13,9%)	31 (19,1%)	28,4 + 7,5	Income/discharge Balance of +18.3 patients daily.
						Postponement of 9 long-stay surgical admissions.
						Availability of critical beds outside the Healthcare Area [7].
						Perimeter closure of 13 municipalities in the Region.
						Maintaining two Surgical Committees meetings per week.
January 27, 21	--	12.90 %	179 (15,8%)	43 (26,5%)	21,5 + 2,5	Postponement of delayable activity [10].
						Major Ambulatory Surgery Unit enabled 50% as Resuscitation Unit.
						Maintenance of Major Ambulatory Surgery Unit activity > 50%.
February 1, 21	628.8	6.80 %	191 (16,8%)	49 (30,2%)	19,7 + 4,8	Perimeter closure of 16 municipalities in the Region.

						Occupation of 90% of the critical beds of the "Intensive Care Unit-8" (formerly, locker room)
						Opening "Intensive Care Unit -9" (formerly, gym [11]) on February 4, 2021.
February 8, 21	644.1	8.50 %	203 (17,9%)	66 (40,7%)	21,0 + 7,5	Perimeter closure of 18 municipalities in the Region on February 8, 21.
						Perimeter closure of 19 municipalities in the Region on February 12, 21.
February 15, 21	485.3	6.10 %	177 (15,6%)	78 (48,1%)	23,0 + 7,3	Perimeter closure of 16 municipalities in the Region.
					(Major Ambulatory Surgery Unit: in the afternoon resulted 48,3% out of the total activity)	
February 22, 21	311	6.80 %	140 (12,3%)	73 (45,1%)	25,0 + 7,8	Perimeter closure of 15 municipalities in the Region.
						Progressive perimeter opening, according to indicators [12].
						Occupation of 90% of the critical beds of the "Intensive Care Unit-8", and >50% of "Intensive Care Unit -9".
						Starting of vaccination campaign of the following Group [13].
						Perimeter closure of 6 municipalities in the Region on February 26, 21.
March 1, 21	198.2	8.20 %	117 (10,3%)	64 (39,5%)	25,0 + 9,0	Perimeter closure of 5 municipalities in the Region
						Continuing vaccination.
						Hospital occupancies of critical COVID-19 patients in others centers in the Region were exhausted.

Table 1: The accumulated incidence rates in the population, hospital occupancy, and the most relevant events that have occurred during the third pandemic wave.

Methods

This is a retrospective and descriptive study of consecutive cases, which studied surgical activity both in quantity and quality. In particular, it focused on patient safety [14], regarding the maintenance and adaptation of the measures taken in strategical and organizational aspects during the different waves of the pandemic.

For this purpose, the activity and measures carried out in the first wave [1] and second one [2] were studied and contrasted with those at the third wave (February '21). Various references were included in terms of activity, clinical safety indicators, as well as accumulated incidence rates, and percentages of hospital occupancy in our Healthcare Area.

Both the scope, care circuits, protocols of action in the surgical area and exclusion criteria have been described previously [1,2].

Regarding ethical aspects, including those related to patients, workers or the handling of information to patients and their families, they were maintained in the same conditions as in both previous pandemic waves [1,2].

During the third pandemic wave, there were periodic screening PCR tests among professionals and users [15] as in the second wave, in addition to performing them on suspected cases as in the first wave [1].

Results

Care indicators are described below, according to each pandemic wave (Table 2) [16]. Data description and their limitations were published previously [1,2].

	1 st . wave	2 nd . wave	3 rd . wave
Hospital occupancy (%)	58.3	81.6	83.5
Maximum of accumulated incidence rate per 100.000 inhabitants in the last 14 days.	87.9	151.0	644.1
Maximum Number of critical beds occupied for COVID-19 patients	58	87	92
Number of working beds	984	940	984
Average of overall hospital stay per patient (in days)	9.3	8.3	9.1
Median of stay per patients in Surgical Services (in days)	6.4	4.4	5.1
Hospital mortality index (%)	5.6	5.3	7.4
Index of deaths in Surgical Services out of number of discharges (%)	1.6	0.8	0.008
Total number of available operating rooms per working day	23	31	31
Number of specific operating rooms available for COVID-19 patients per day	4	2	2
Number of available emergency operating rooms per day	4	2	2
Number of operating rooms scheduled morning (average)	14.1	22.1	20.2
Number of operating rooms scheduled afternoon (average)	2.2	7.4	7.1
Number of scheduled patients operated on per working day (average)	17.3	62.8	42.3
Ratio of scheduled ambulatory/admitted interventions (%)	7.6	47.5	49.3
Number of total transplants performed (including renal, hepatic and cardiac)	8	17	12
Scheduled surgical performance (morning and afternoon, %)	81.3	74.1	75.8
Surgical suspensions (%)	2.3	3.9	2.0
Number of patients in Surgical Waiting List registry (last day of the month)	7849	7456	9977
Average of delay to be operated on (last day of the month, in days)	90.1	106.6	42.5
Number of patients waiting for operation more than 180 days (last day of the month)	925	1123	424

Table 2: Activity data.

The proportion of PCR positivity was 1.6% during the first wave (with all the limitations mentioned) [1]; it reached a peak around 10.5% during the second wave [2], while it was around 12.9% during the third one [17].

Discussion

On December 28, 2020, the accumulated incidence per 100,000 inhabitants in the last 14 days in the Region was 116.5 cases, the lowest in the country, which presented a range of 116.5 to 514.4 cases. At that time, the national average was 246.2 cases. However, within our Region this average rate oscillated between municipalities; from zero cases in many municipalities, to others that reached national maximums, with 461.9 cases in a municipality on the western edge, 571.0 cases in a municipality on the eastern edge, 533.3 cases in a municipality on the southern edge, or 413.9 cases in a northern coastal municipality [6]. It was the beginning of the third wave in our Region.

The accumulated incidence in each pandemic wave was increasing during the third wave, but it was stopped coinciding with the perimeter closures of some municipalities and the whole Region, the social and hygienic measures taken and the starting of vaccination in our Healthcare Area which began since December 28, 2020, and now is being continued, depending on the availability of doses, and according to the protocol established by Health Authority [13].

The epidemic caused by COVID-19 has been forcing us to adapt ourselves to the challenges that we were encountering daily, from its first to its third wave, which, nowadays, has stabilized and started to decline in our Healthcare Area, although more slowly than the previous ones.

Taking into account this disease and the necessary safety conditions for the health care of all patients, our adaptability were greater, until having reached the optimal point possible between prior Health Planning, and the improvisation of both urgent and scheduled surgical care, and for both COVID-19 and Non-COVID-19 patients care.

In fact, a concept that is gaining momentum is the so-called "Strategic Adaptation", which may replace "Strategic Planning". In this third wave, this Strategic Adaptation was materialized in the following actions:

1. The actions implemented and systematized during the two previous pandemic waves [1,2] were maintained, both in care circuits, as well as in the management of personnel and material resources, in terms of accessibility, safety and equity.
2. The available resources, both in terms of structure and personnel, were similar to the previous pandemic waves, although the workers retirements limited the availability of people, so the maximum surgical activity of available operating rooms could not be reached. This fact explained the minor number of operating rooms scheduled in the morning and in the afternoon also, compared to second wave. In general, the stock of applicants for public employment was exhausted during the second wave [2] and continued during this third wave, due to their hiring for both the increasing demand for assistance and the coverage of the new structures opened. In fact, the available professionals had to bear a greater workload in the morning, and an increase in paid hours in the afternoon, already started months ago, as well as in the night shift. Moreover, the greater pressure from the patients registered in the surgical waiting list hindered the administrative and organizational work at the Surgical Services also.

The presence of outbreaks among health personnel continued to be evidenced and systematic actions were taken in a similar way to previous waves [1,2]. However, it has been observed that they have been gradually decreasing in frequency and in the volume of affected people, according to the vaccination of the most vulnerable elderly people (group 1), and health personnel (group 2) [13].

3. Regarding the availability of postsurgical critical beds:

- a. Compared to previous waves, this third wave began with 26 critical beds occupied by COVID-19 patients (coming from the second wave), which meant 20.3% of the maximum capacity in the second wave, or 16.1% of the new capacity with 162 beds [18]. Therefore, the global capacity for critical patients care, both in the Healthcare Area and in the rest of the Region was lower than in previous waves [7]. However, it was not necessary to reconvert new healthcare spaces into critical care units, because hospital occupancy reached the maximum peak of 92 COVID-19 patients, on February 15, 2021. So, the recommended measure [14] consisting of resuscitating the patient in the same operating room has not been necessary in our center, since the maximum installed occupancy of critical beds was not reached. In addition, some provisional critical units were set up in our center also [2].
 - b. The available new critical units were occupied earlier than in the previous wave (the so-called “UCI-8” located in an old locker room, and “UCI-9”, our gym). This made it possible to have critical beds for post-surgical patients (mostly Non-COVID-19) in their usual locations.
 - c. It was decided to maintain half of the surgical day hospital provision, both in number of beds and personnel involved. This made it possible to maintain an outpatient surgical activity close to 50%, and higher than in the previous waves. The other half of this unit was available for the care of post-surgical critical patients, together with the rest of the resuscitation and post-anesthetic critical care units. This significant volume of patients operated on in both the second and third wave, on an outpatient basis, has led to a significant reduction both in the average delay in days, and in the number of patients waiting for operation more than 180 days.
 - d. The collaboration of personnel belonging to all the available critical care services (anesthesia, pediatrics, intensive care, cardiologists, etc.) in the Healthcare Area has been established from the first moment and maintained at its peak of incidence and continuing nowadays.
 - e. The patients registered with a priority type 3 (delayable, not oncological) [10] and with a type of medium/long hospital bed occupancy [19] was selected to be postponed during each pandemic peak of hospital occupancy. Our results did prove that this last criterion was followed by the Heads of Surgical Services, which managed to reduce 2 days of stay per patient operated on during the second wave and 1.3 days per patient during the third one, compared to the first wave.
4. On the other hand, regarding the availability of the “working operating room” resource:
- a. Since the second pandemic wave [2], the daily volume of surgical emergencies of the previous waves also taught us that enabling two emergency operating rooms was sufficient to guarantee such assistance, increasing the maximum capacity of scheduled operating rooms if necessary.
 - b. We have learned that the volume of surgical COVID-19 patients, both as an emergency or as a delayed activity, was very scarce, so the availability of operating rooms enabled for this purpose has been reduced from 4 daily operating rooms [1] to two, since the second pandemic wave [2], where one of them was specifically for adults and another one for children only.
 - c. The activity of the Mother-Child Surgical Block has been minimally modified, since there were different circuits and locations both for pediatric and adult patients, as well as for pregnant patients compared to the rest. This pediatric surgical programming was only limited by the availability of personnel from the Surgical Services, and the voluntary nature of families (limited by fear of going to a COVID-19 center, or being in a face-to-face school course, among others).

- d. Thus, the Donation and Transplantation Program was maintained under normal conditions, although the absolute terms during the first pandemic wave was lower than the rest of waves [1]. As an exception, 2 organs were rejected for transplantation during the third wave, due to the peak occupation of the critical beds of Non-COVID-19 and coinciding with the peak of the third wave of the pandemic, on February 15, 2021.
- e. The limited availability of scheduled operating rooms in the first wave led to above-standard surgical performance, which normalized in the second and third waves. The use and exploitation of programmed operating rooms has been higher in the third wave than in the second, which results in a reduction of the number of patients waiting for operation more than 180 days.
- f. The programmed surgical activity has been maintained, oscillating between a daily maximum capacity of 27 sessions in the morning and 11 sessions in the afternoon (reached on Thursday, February 25, 2021) and a minimum of activity (reached on February 3, 2021), where 19 sessions in the morning and 2 sessions in the afternoon were performed. To achieve this objective of coordination, a total of 3 weekly critical committee meetings and 2 weekly surgical block committee meetings were established during the pandemic wave periods, which facilitated the adaptation of the number of beds and available personnel (limited in each time for different reasons, such as sick, or outbreaks, among others) to the surgical activity planned to develop the following two or three days.

The scheduled surgical activity performed per working day allowed us to compare the different pandemic waves, where a significant increase during the second wave were observed, compared to the first one [2]. This behavior was maintained throughout the third wave, with a significant increase in outpatient care compared to hospitalized care.

This increase in the scheduled surgical activity (although in absolute terms it is biased data, because the different working days between the compared months) occurred both in admitted and ambulatory patients, despite the “metamorphosis” of the Major Ambulatory Surgery Unit (that became a Resuscitation Unit since January 27, 2021), as occurred during the second wave [2].

On the other hand, the definition of “COVID-19 operating room” is a matter of equipment and trained and available personnel, as well as differentiated circuits. Therefore, if necessary, they could be increased in number, or on the contrary which happened in some cases, used by patients not infected by COVID-19.

Conclusion

Despite the limitations of our study, we can prudently deduce the follow: The incidence rates in our environment were higher throughout each pandemic wave, along which a change in the strategic approach was observed. These strategic lines made it possible to improve surgical activity, ensuring the safety of surgical patients, which required a greater level of adaptation and workloads from the professionals in the organization.

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