

How Anaesthesiology Helped to Fight the First Wave of the COVID-19 Pandemic in Portugal

Como a Anestesiologia Ajudou a Combater a Primeira Vaga da Pandemia de COVID-19 em Portugal

Paulo LEMOS¹, Alexandra GUEDES¹, António P. MARTINS¹, Carmo BRANCO¹, Clara LOBO¹, Joana MOURÃO¹, José S. PINTO¹, Nuno SERRANO¹, Rosário ABRUNHOSA¹, Susana CADILHA¹, Valentina ALMEIDA¹

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ABSTRACT

Introduction: The dissemination of the COVID-19 pandemic in Europe, namely in Portugal, demanded an organizational and clinical reaction from the Portuguese National Health Service. With the unpredictable impact of COVID-19 infected patients redefining hospital logistics, reducing non-priority elective care and extending the hospital capacity for critical care patients made mobilizing a significant part of human resources a priority. We conducted a national survey to monitor the contribution and the role of anaesthesiologists belonging to the 53 Portuguese National Health Service hospitals in the first wave fight against the pandemic.

Material and Methods: This prospective cross-sectional observational study used a weekly survey sent to the Directors of the Anaesthesiology Departments of all Portuguese National Health Service hospitals, between the period of 13th April and 21st June 2020. Directors were asked about human resources, hospital logistics, anaesthetic activity and residency programs in their departments as well as contingency plans facing the impact of the pandemic growth in the PNHS.

Results: Contingency strategy for all Portuguese National Health Service hospitals planned for a total of 1524 level III critical care beds during the initial phases of the pandemic, an increase of 151% from the existing 607 level III critical care beds in Portugal in January 2020. This re-configuration effort of the Portuguese National Health Service was only possible due to the partial or total suspension of non-urgent elective activity that reached over 90% of these institutions in the first pandemic months (March and April) and the deployment of anaesthesiologists from their normal activities to the treatment of critical care patients. During the peak of the first pandemic wave, 209 anaesthesiology specialists and 170 trainees (22.9% of the total anaesthesiologist's staff in the Portuguese National Health Service) were deployed in critical care. There was an almost complete interruption of the residency program rotation in 70.4% of hospitals with anaesthesiology residents, between March and April 2020.

Conclusion: During the first pandemic wave there was an effective and fast reorganisation of the Portuguese National Health Service in order to increase level III critical care beds, which might have contributed to the low mortality rates in Portugal. We believe that this could have also been a result of the contribution given by all public anaesthesiology departments.

Keywords: Anesthesiology; COVID-19; Critical Care; Health Personnel; Health Planning

RESUMO

Introdução: A disseminação da pandemia por COVID-19 na Europa, designadamente em Portugal, exigiu uma resposta clínica e organizativa por parte do Serviço Nacional de Saúde português. Com o imprevisível impacto da COVID-19 nos doentes infectados, foi prioritário redefinir a logística hospitalar, reduzir a prestação de cuidados electivos não prioritários, e estender a capacidade hospitalar ao tratamento do doente crítico, mobilizando uma parte significativa dos recursos humanos. Utilizou-se um inquérito nacional que permitisse monitorizar a contribuição que os anestesiolistas pertencentes aos 53 hospitais do Serviço Nacional de Saúde tiveram no combate à COVID-19 durante a primeira vaga da pandemia.

Material e Métodos: Estudo observacional transversal de tipo prospectivo, baseado num inquérito semanal enviado aos directores dos Serviços de Anestesiologia de todos os hospitais do Serviço Nacional de Saúde, entre 13 de abril e 21 de junho de 2020. Foi solicitada informação relativa aos recursos humanos, logística hospitalar, atividade assistencial, programa de formação pós-graduado, assim como plano de contingência face ao crescimento da pandemia.

Resultados: O plano de contingência hospitalar nos hospitais do Serviço Nacional de Saúde previu um total de 1524 camas de cuidados intensivos de nível III, o que corresponde a um crescimento de 151% das 607 camas existentes em janeiro de 2020. Esta reconfiguração dos hospitais do Serviço Nacional de Saúde só foi possível devido à suspensão parcial ou total da atividade eletiva não prioritária que afectou mais de 90% das instituições hospitalares nos primeiros meses da pandemia (março e abril), e à mobilização dos anestesiolistas das suas atividades eletivas para o tratamento do doente crítico. Nos piores momentos, esta mobilização envolveu 209 especialistas e 170 internos de especialidade (22,9% do total destes profissionais nos hospitais do Serviço Nacional de Saúde). Por outro lado, registou-se uma interrupção quase total do programa de formação pós-graduada em mais de 70,4% dos hospitais com esta idoneidade formativa, de março a abril de 2020.

Conclusão: Durante a primeira vaga da pandemia houve uma rápida reorganização do Serviço Nacional de Saúde que poderá ter contribuído para a baixa taxa de mortalidade em Portugal. Os autores acreditam que para esse resultado poderá ainda ter contribuído a ajuda dada pelos serviços de Anestesiologia do Serviço Nacional de Saúde.

Palavras-chave: Administração de Recursos Humanos; Anestesiologia; COVID-19; Cuidados Intensivos; Planeamento em Saúde

INTRODUCTION

In December 2019, 27 patients who had been at the Huanan seafood market, in the Chinese Province of Wuhan were reported to have a severe viral pneumo-

nia.¹ This disease caused by the severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) was defined by the World Health Organisation (WHO) as

1. Board of the Portuguese College of Anaesthesiology. Portuguese Medical Association. Lisbon. Portugal.

✉ Autor correspondente: Paulo Lemos. pauloferreiralemos@gmail.com

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coronavirus disease 2019 (COVID-19), according to the International Committee on Taxonomy of Viruses.² On the 30th January 2020, the WHO declared the COVID-19 epidemic as a public health emergency of international concern – PHEIC, and on the 11th March declared it as a pandemic disease.

The first cases in Portugal were reported on the 2nd March 2020, and the first death on the 17th March. The Portuguese Government implemented a State of Emergency on the following day.³ The Portuguese Directorate General of Health (DGS) announced the beginning of the mitigation phase on the 26th March 2020 in order to control disease dissemination due to the existence of community transmission.⁴ On the 30th March 2020, the Portuguese Government decided to raise the containment measures, replacing the State of Emergency with the State of Calamity with a bi-weekly periodic evaluation, beginning on the 4th May.⁵

Due to the high transmissibility rate⁶ COVID-19 quickly spread in Portugal, forcing hospitals of the Portuguese National Health Service (PNHS) to undergo a logistic reconfiguration and to establish separate circuits and specific areas for the diagnosis and treatment of these patients. By ministerial order on the 16th March, it was decided that CEO's of all public hospitals should suspend, as much as possible, all non-urgent elective care activity that, by its nature or clinical priority, was not life limiting, or limiting for an individual prognosis.⁷

The hospital re-configuration of areas providing separate circuits (for patients awaiting COVID-19 testing results; for COVID-19 positive patients; for COVID-19 negative patients), and suspension of non-urgent elective care, led to a re-organisation of anaesthesiology departments. Due to the functional competence and versatility recognised in anaesthesiologists it was not surprising that these professionals were rapidly mobilised to reinforce Intensive Care Unit (ICU) medical teams, to lead and organise new ICUs, and to see them involved in the Emergency department or areas that are usually under the responsibility of intensive care medicine doctors.

The Board of the Portuguese College of Anaesthesiology developed a national survey to monitor the contribution of this speciality in the fight against the first wave of the pandemic in Portugal.

MATERIAL AND METHODS

Ethics committee approval for this study was not required because no animals or patients were involved. In addition, and for the same reasons, it was not necessary to obtain any patient consent.

This prospective cross-sectional observational study was based on a weekly survey sent to the Directors of the Anaesthesiology departments of all 53 PNHS public hos-

pitals (including the hospitals of the Autonomous Regions of Azores and Madeira and the Armed Forces Hospitals in Lisbon and Porto), asking for a characterisation of the department and the hospital with data relative to January 2020, and to add weekly information between the week beginning on Monday 13th April, until the week beginning on Monday, 21st June 2020. These would allow the continuous monitoring of all changes occurring in those institutions for 10 weeks.

Regarding hospital characterisation, the data requested included human resources (number of staff, anaesthesiologists and residents), logistics (number of level III & II critical care beds; number of operating rooms; number of remote locations where anaesthesiologists performed anaesthesia outside operating room; number of post-anaesthetic care unit beds; and number of ventilators), anaesthetic activity (non-urgent elective care in operating rooms or outside it, anaesthesia and pain consultations), teaching activity, and the impact of COVID-19 on absenteeism among anaesthesiologists due to SARS-CoV-2 infection or to quarantine, were all analysed. There was a focus on collecting data related to contingency planning, based on the capacity to increase the number of level III critical care beds. Finally, the implementation of good practices, such as the creation of separate patient circuits, testing admitted patients to hospital, testing patients undergoing surgery, creation of dedicated operating or delivery rooms, use of high efficiency particulate air (HEPA) filters, and use of adequate masks and proper personal protective equipment (PPE), were also included in the weekly survey.

RESULTS

Fifty-three PNHS surgical public hospitals were included, representing all the public hospital network, including the three hospitals from the Autonomous Regions of the Azores and only one from Madeira Island, and the two Hospitals of the Armed Forces in Lisbon and Porto.

The 47 public hospitals in mainland Portugal are regionally distributed according to five main health administrative regions with: 15 hospitals in the North; 10 hospitals in the Centre; 16 in the Lisbon and Tagus Valley region; four in Alentejo; and two in Algarve.

Hospital characterisation in January 2020, regarding human resources, logistics, and anaesthesia and teaching activity is presented in Table 1.

In order to prepare for the impact of the first pandemic wave (March and April 2020), PNHS hospitals underwent reorganization to give priority to the treatment of COVID-19 infected patients, especially those needing critical care. For this purpose, PNHS hospitals, foreseeing the likely possibility to more than twice the number of level III critical care beds

existing in Portugal, developed contingency plans to avoid chaotic situations like those occurring in Italy, France and Spain^{8,9} (Table 2).

Following the ministerial order on the 16th March 2020, that all public hospitals should as far as possible suspend

all non-urgent elective care,⁶ there was a reduction in the elective anaesthesia and teaching activity in the majority of anaesthesiology departments. Monitoring 10 weeks between the 13th April and the 21st June enabled the authors to analyze the behaviour of the clinical and teaching activity

Table 1 – Hospital characteristics in January 2020, regarding human resources in anaesthesiology, logistics and anaesthetic and teaching activity (n = 53)

Hospital characterisation in January 2020		n	%
Human Resources	Total	1719	
	Anaesthesiologists from departments of Anaesthesiology	1192	69.3%
	Anaesthesiologists from other departments (ICU, Pain Clinic, ...)	67	3.9%
	Residents of Anaesthesiology	460	26.8%
Logistics	Hospitals with ICU	42	79.2%
	Number of Level III ICU beds	607	
	Number of Level II ICU beds	490	
	Number of Level II ICU beds equipped with ventilator	124	25.3%
	Total number of operating rooms	622	
	Number of operating rooms exclusively dedicated to emergency	91	14.6%
	Number of remote locations or room for procedures	223	
	Number of remote locations or room for procedures equipped with ventilator	149	66.8%
	Number of beds in post-anaesthesia care units	881	
	Number of beds in post-anaesthesia care units equipped with ventilator	92	10.4%
Types of Anaesthetic Services	Non-emergent surgery	53	100%
	Labour analgesia clinic	42	79.2%
	Remote location anaesthesia	49	92.5%
	Anaesthesia clinic	53	100%
	Acute pain clinic	49	92.5%
	Chronic pain clinic	47	88.7%
	Teaching activity	27	50.9%

ICU: intensive care unit

Table 2 – Impact of contingency plans developed in Portuguese National Health Service (PNHS) public hospitals to fight COVID-19, involving anaesthesiology (n = 53)

Contingency planning to fight COVID-19 involving anaesthesiology		n	%
Contingency planning	Director of Anaesthesiology knows that there is a contingency planning	52	98.1%
	Director of Anaesthesiology was involved in the contingency planning	38	71.7%
	Hospitals that planned an increase in level III ICU beds	47	88.7%
	Total number of level III ICU beds in the final phase of contingency planning	1524	151.1%
Anaesthetic involvement	Anaesthesiology department is part of the contingency planning	44	83.0%
	Assuming tasks in ICU	35	66.0%
	Assuming tasks in Emergency Room	26	49.1%
	Assuming Internal Medical Emergence	27	50.9%
	Assuming coordination in endotracheal intubation teams	37	69.8%
	Assuming leadership in new ICU	26	49.1%
	Not involved in COVID-19 fighting	4	7.5%

ICU: intensive care unit

Table 3 – Reduction in elective anaesthetic and teaching activity

Reduction in the elective anaesthetic and teaching activity	Week of April 13 th to 19 th		Week of May 11 th to 17 th		Week of June 15 th to 21 st	
	n	%	n	%	n	%
Elective surgery (n = 53)	51	96.2%	32	60.4%	6	11.3%
Remote location anaesthesia (n = 49)	39	79.6%	26	53.1%	7	14.3%
Anaesthesia clinic (n = 53)	50	94.3%	30	56.6%	12	22.6%
Acute pain clinic (n = 49)	24	49.0%	19	38.8%	5	10.2%
Chronic pain clinic (n = 47)	44	93.6%	22	46.8%	6	12.8%
Teaching activity (n = 27)	19	70.4%	8	29.6%	2	7.4%

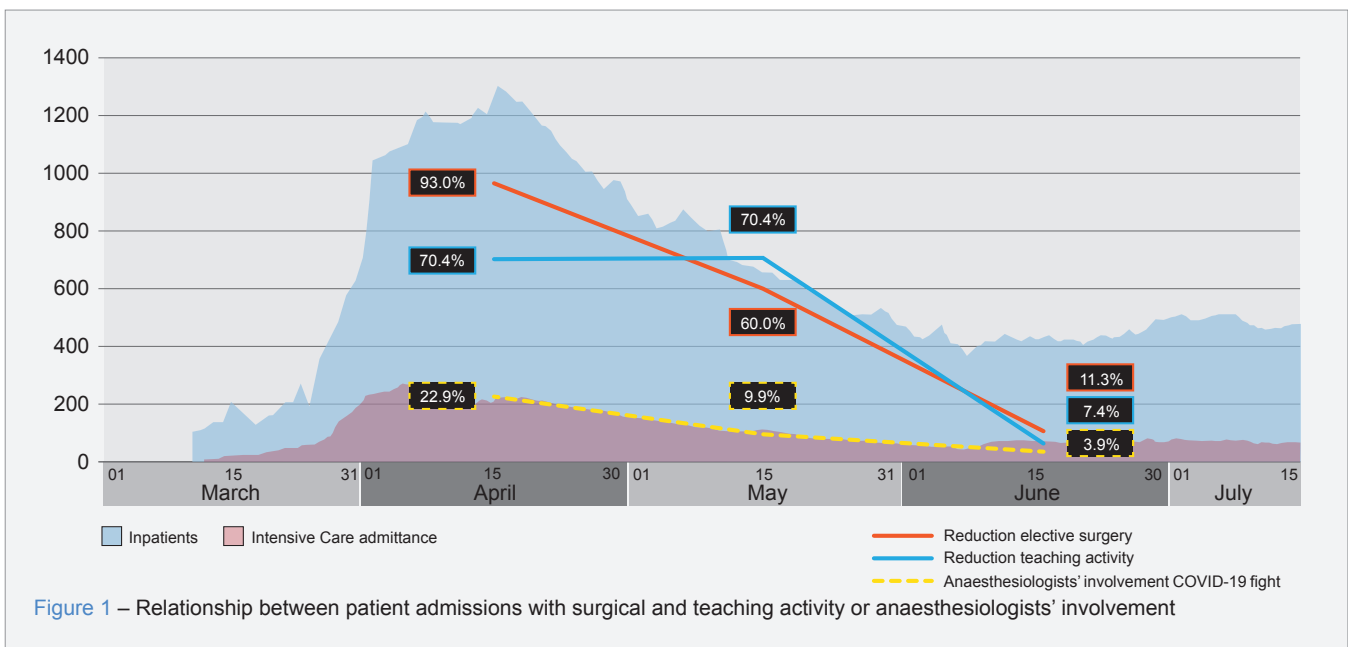


Figure 1 – Relationship between patient admissions with surgical and teaching activity or anaesthesiologists' involvement

Table 4 – Involvement of anaesthesiologists in the fight against COVID-19, during first wave

Involvement of anaesthesiology staff in COVID-19 fighting	Week of April 13 th to 19 th		Week of May 11 th to 17 th		Week of June 15 th to 21 st	
	n	%	n	%	n	%
Anaesthesiology departments with staff dedicated to COVID-19 fight (n = 53)	31	58.5%	25	47.2%	12	22.6%
Anesthesiologists dedicated to COVID-19 fight (n = 1192)	209	17.5%	89	7.5%	34	2.9%
Anaesthesiology residents dedicated to COVID-19 fight (n = 460)	170	37.0%	74	16.1%	32	7.0%

responses as the pandemic evolved, in different time periods (Table 3). The first situation point coincides with the first lockdown (April 13th to 19th), the second situation point coincides with resumption of surgical activity (May 11th to 17th) and the third situation point with the return of full surgical activity (June 15th to 21st), after the end of the first wave.

Figure 1 shows a direct relationship between the increase of the number of admitted patients with SARS-CoV-2 in hospitals and an increase in the suspension of elective anaesthetic activity, interruption of teaching

activity, and involvement of anaesthesiologists in several tasks related directly or indirectly with COVID-19 patients, as shown in Tables 2 and 3.

The impact of the involvement of anaesthesiologists in the pandemic first wave is described in Table 4, especially during the month of April.

Table 5 points out the number of affected anaesthesiology staff, with COVID-19 disease or quarantine, during the studied period, again with more impact in the month of April.

With the passage of time and our increasing knowledge

Table 5 – Affected anaesthesiologists during first wave COVID-19

Affected anaesthesiology staff during first wave COVID-19	Week of April 13 th to 19 th		Week of May 11 th to 17 th		Week of June 15 th to 21 st	
	n	%	n	%	n	%
Anaesthesiologists infected with COVID-19 (n = 1192)	23	1.9%	3	0.3%	2	0.2%
Anaesthesiology residents infected with COVID-19 (n = 460)	4	0.9%	1	0.2%	0	0.0%
Anaesthesiologists in quarantine (n = 1192)	18	1.5%	9	0.8%	2	0.2%
Anaesthesiology residents in quarantine (n = 460)	2	0.4%	2	0.4%	1	0.2%

of the disease, it was possible to identify and implement a set of good practices that enabled the prevention of further spread of the disease and the increase of both patient and healthcare professional safety (Fig. 2).

In the first pandemic wave, between the 3rd March and the 15th July 2020, Portugal had 47 426 patients infected with SARS-CoV-2 virus, and 1677 deaths with COVID-19, with a mortality rate of 3.5%.¹⁰ Until June 2022, it is estimated that Portugal has had over four million infected with SARS-CoV-2 virus and 22 583 deaths with COVID-19, with a mortality rate of 0.56%. This corresponds to the 41st highest in the World.¹¹

DISCUSSION

The need to tackle the COVID-19 Pandemic led to an urgent hospital re-configuration, with the creation of separate circuits (for patients awaiting COVID-19 testing results; for COVID-19 positive patients; for COVID-19 negative patients), nurseries and ICUs dedicated to COVID-19 infected and COVID-19 free patients, and the re-organisation of hospital human resources needed to face these new constraints.

Confronted with this new devastating pandemic, the first issue was the expansion of the number of level III critical care beds, considering the fact that it was already known that the number in Portugal was clearly insufficient for the

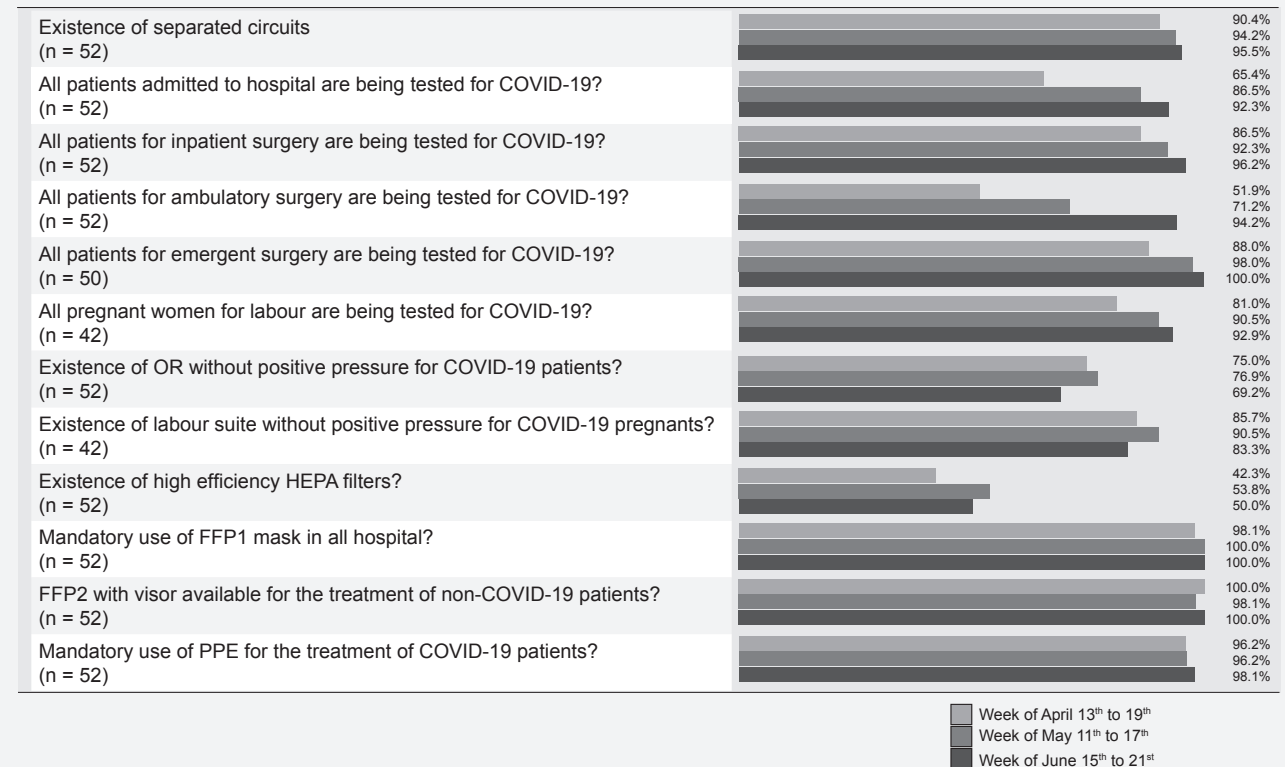


Figure 2 – Hospital implementation of good practices to fight COVID-19

OR: operating room; FFP: filtering face piece; PPE: personal protective equipment; HEPA: high efficiency particulate air

treatment of the critical care patients on a regular basis. The authors found that, in January 2020, Portugal had 607 level III critical care beds, which meant a rate of six beds per 100 000 population, which was much lower compared with other European countries like Germany (35.3), Croatia (33.5) or Austria (26.4) and similar to countries like Sweden (5) or Denmark (6.4).¹² According to the contingency plans, it was possible to predict, for the final stages, a total of 1524 level III critical care beds, which meant a 151.1% increase (corresponding to a ratio of 15.24 beds per 100 000 patients), and which was more aligned with rates in the majority of Central European countries.¹²

The extra level III critical care beds were provided in several areas within hospitals. The use of areas already equipped with ventilators and monitors such as post-anaesthesia care units (PACU) or operating rooms was common even though the contingency plans of some hospitals supported the use of other ward areas. With this sudden expansion came the need to re-allocate human resources for these areas.

These healthcare professionals came from those areas where non-urgent elective activities were suspended (some surgical wards, operating rooms and PACU). In relation to the deployment of Anaesthesiology staff, this targeted, at the worst times of the first pandemic wave, 209 specialists and 170 trainees (22.9% of the total anaesthesiology staff based on the 1192 anaesthesiologists and 460 trainees available in PNHS Hospitals), in the week of the 13th to the 19th April. These results were similar to those reported in other countries like the United Kingdom.¹³ Kursumovic *et al*¹³ found the overall impact on national anaesthesia staff to be a 29% loss in January 2021 (due to redeployment to critical care, non-patient facing roles, shielding, self-isolation, quarantine and sickness as a result of COVID-19).

These anaesthesiology specialists were involved in different scenarios, not only in ICU areas (old and new units), but also in internal and external emergency departments, or assuming coordination in endotracheal intubation teams, as happened in other countries.¹⁴ Trainees had their residency programs suspended and in most cases were redeployed to triage zones of accident and emergency departments, or even in wards for the treatment of COVID-19 patients. For this reason, their internships at national level were postponed for two months to compensate for the suspension of their residency program. Anaesthesiology was one of the medical specialties most exposed to the front-line fight against this pandemic and it turned out to be one of the most affected medical specialties (by infection or confinement) by the SARS-CoV-2 virus, at least in Portugal.

As in other countries, we found difficulties in equipping new ICUs due to the global shortage of ventilators and monitoring equipment. For that reason, operating rooms and PACU areas were transformed and adapted into new

ICU facilities to increase the critical care capacity nationwide.

The need to increase the response to COVID-19 patients led to a substantial reduction in non-urgent elective activity, affecting, especially in April, all, except four, PNHS hospitals. This was also observed in several countries around the world.¹⁵⁻¹⁷ This was particularly noticed in elective surgery, remote locations, and anaesthesia and chronic pain clinics, where almost all planned activities ceased.

The reduction in all non-emergent procedures during the first pandemic wave was also due to the fear of acquired SARS-CoV-2 infection in hospitals and the risk of increasing the perioperative risk of morbidity and mortality. One large study estimated the 30-day mortality for those patients with peri-operative SARS-CoV-2 infection to be 23.8%, with worse outcomes in those undergoing emergency surgery (25.6% vs 18.9%).¹⁸

The above reasons led to the cancellation of millions of surgical procedures worldwide. The COVIDSurg Collaborative estimated that over 28 million surgical procedures in 190 countries would be cancelled in the pandemic peak period.¹⁹

To mitigate the spread of the viral infection and increase the safety of patients and health professionals, hospitals felt the need to implement a set of good practices: separate patient circuits, patient testing at hospital admission or before surgery, creation of dedicated operating and delivery rooms, use of HEPA filters, and use of adequate masks and proper PPE. This was not all readily available in the beginning, due to the overwhelming demand worldwide. However, there was a positive evolution towards its implementation as the impact of the pandemic grew.

Finally, our data illustrates very clearly that anaesthesiologists (and of course other healthcare providers working in operating theatres) were crucial in the critical care response to the pandemic.

This study has some limitations since it only gives a limited picture about the impact of the pandemic in the first wave. Although in hindsight this first wave was not the most dramatic in terms of number of patients infected or deaths, it nevertheless demanded a quick and effective response from the PNHS. In the face of the unpredictable fight that was to come against the pandemic it allowed the PNHS to be prepared for future pandemic waves.

CONCLUSION

The COVID-19 pandemic has placed a substantial strain on PNHS around the country. However, the effective reorganisation of the PNHS with restriction of elective surgeries that enabled the expansion of critical care resources to accommodate the increased COVID-related demands, resulted in Portugal having a low mortality rate during the first wave and allowed the healthcare system to be prepared for

the following pandemic waves. We believe that this could have also been a consequence of the contribution provided by all public anaesthesiology departments.

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AUTHOR CONTRIBUTIONS

PL: This author helped design and conduct the study, helped with data collection and analysis, and drafted the manuscript.

AG, APM, CB, CL, JM, JSP, NS, RA, SC, VA: These authors helped design and conduct the study, helped with data analysis, and revised the manuscript.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in 2013.

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DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

COMPETING INTERESTS

PL: President of the Anesthesiology Board at Ordem dos Médicos. President of the General Assembly of the Associação Portuguesa de Cirurgia Ambulatória. Treasurer of the Portuguese Association for Development and Education in Anaesthesia.

AG, APM, CB, CL, JM, NS, RA, SC: Member of the Anaesthesiology Board at Ordem dos Médicos.

JSP: Member of the Anesthesiology Board at Ordem dos Médicos. Management Board Member of the Associação Portuguesa de Cirurgia de Ambulatório.

VA: Member of the Anesthesiology Board at Ordem dos Médicos. President of the Accreditation of Training in Anaesthesiology and Intensive Care (ATAIC).

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