Minerva Chirurgica (New title: Minerva Surgery)
EDIZIONI MINERVA MEDICA

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Minerva Surgery 2021 Aug 02
DOI: 10.23736/S2724-5691.21.08919-X

Article type: Original Article

Supplementary material available online at http://www.minervamedica.it
Article first published online: August 2, 2021
Manuscript accepted: May 11, 2021
Manuscript received: April 12, 2021

Impact of Covid-19 on surgical activities and personnel: lessons for the future

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Comitato Etico di Area Vasta Emilia Centro della Regione Emilia-Romagna : Registration (N° 0012834 Chirurgie Covid-19 of the Local Protocollo Generale dated 28 April 2020,) and Ethical Committe approval : CEAVEC 406/2020/Oss/AOUFe-AUSLFe , dated 21 April, 2020. All experimental protocols were approved by the Local institutional and licensing committee

Declarations:

All methods were carried out in accordance with relevant guidelines and regulations.

Ethical Approval and consent to partecipate:

All experimental protocols were approved by the named ethics committee : Comitato Etico di Area Vasta Emilia Centro della Regione Emilia-Romagna :

Registration (N° 0012834 Chirurgie Covid-19 of the Local Protocollo Generale dated 28 April 2020) and Ethical Committe approval : CEAVEC 406/2020/Oss/AOUFe-AUSLFe , dated 21 April, 2020.

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The authors declare to comply with the journal's ethical policy.

Consent for pubblication

Informed consent was obtained from all individual participants included in the study.

Availability of data and materials

All matherials are available in the supplementary file

Competing interests

The authors declare that they have no conflict of interest.

Funding

The authors declare as well they have not received any grant supporting the research,

Authors 's contribution

MR : Conceptualization, Methodology, Investigation, Data Curation, Writing - Original Draft, Visualization.

PG, VG, SO,LM,GC ,MAC, CF , Visualization, Supervision, Validation.

GNC,GA,PC,PP, : Data Curation,. Validation,

MEF: Statistic

All other authors : Investigation, data collection

BACKGROUND: Covid-19 pandemic has impacted professional, economic and social activities. In the surgical field, it has brought changes to operating activities, the organization of workforces, the protection measures for patients and personnel against possible intraoperative transmissions as well as training young surgeons. This study intends to assess the extent of this impact in our institution.METHODS :The patients operated on in nine Operating Units(OUs) in the period February 1 - March 31 2020 with follow-ups on April 30 2020 were evaluated both retrospectively and prospectively. Organizational, clinical and impact parameters on staff were evaluated. RESULTS: Of the 833 consecutive admitted patients, 742 were operated on ,705 of whom were recruited for the study. Compared to the same period in 2019 there was a decrease in the number of operations (742 compared to 1187), similar use of intensive care unit (ICU), a diagnostic activity only for symptomatic patients, heterogeneity in organizational behaviors, an impact on staff who highlighted concerns about getting sick or passing the infection on to others (87.64%) or their family members (75.14%).CONCLUSIONS: The study made it possible to detect the need to make significant changes in the clinical, organizational and teaching fields, for which some operational proposals are suggested.
Key words: Covid-19, Surgery, Impact on surgery,Health workforce, Infected patients, Healthcare Insitutions

Background

On March 11, 2020, following the rapid spread of Coronavirus Type 2 (SARS-CoV-2) around the world, the Word Health Organization (WHO) declared pandemic. This act has brought about profound changes in people's lives and important implications from a social, economic and health organization point of view. (1) In Italy the first official case of the infection dates back to February 2020, but the virus was already present among the population several weeks earlier (2,), being responsible for numerous respiratory syndromes that subsequently characterized the clinical expression and the severity of the outcomes. Researchers' attention quickly turned to discover the characteristics of the virus, its transmission routes and mechanisms of action, while politicians and administrators of health systems had to take urgent measures in order to contain the spread of the virus and the consequences of the pandemic. In addition to the limitations on personal freedoms, and the dramatic repercussions on national economies, there has been a need to review the rules for access to care not considered urgent and a conspicuous increase in the availability of beds in ICUs. The medical staff had to cope with it, often in uncomfortable conditions and in the absence of defined rules, mainly making use of their own autonomous ability to intervene and adapt to emergency situations. The impact of Covid-19 on all surgical activities was equally important,(3) resulting in a series of changes in operating routines, in the organization of workforces, in the protection measures of patients and doctors against possible intraoperative transmissions as well as on the education of young surgeons. (4,5,6). The impact of the pandemic on surgical activities has become very topical both in order to reorganize the operating sessions, redefine the priorities and the method of procedural delivery from the point of view of the safety outcomes for patients and healthcare professionals (7,8). A further topic of current discussion relates to the measures to be taken to limit the negative consequences of the virus, the type of commitment that is required of the surgeons (9,10,11) and personal prevention measures (12). In order to contribute to this discussion, a group of OUs, operating in the Sant'Anna University Hospital and in the District Hospital of AUSL of Ferrara, Italy, have, after obtaining authorization from the Ethics Committee, carried out a retrospective and prospective study of their activities. The aim was to

assess the impact that Covid -19 has had both from the organizational point of view and the outcomes for medical and nursing staff. Some suggestions aimed at the future improvement of the surgical activity as a whole are drawn from these experiences.

Methods

The study involved the General Surgery Units 1 (GS1) and 2 (GS2), Gynecology (Gyn), Orthopedics (Ort), Emergency Surgery (ES), Vascular Surgery (VS), Neurosurgery (Neu), and Ophthalmology (Oph) of the Sant'Anna University Hospital and General Surgery (GS3), of the AUSL of Ferrara, Italy (District Hospital). The study regarded three distinct sectors: a)the first relates to case histories and was carried out on retrospective data collection concerning the patients operated on from February 1 to March 31 2020; b) the second relates to the follow-up of the operated patients for 30 post-operative days with a censor on April 30 2020 , the organizational methods and diagnostics on both patients and staff; c) the third relates to prevention measures and the impact on healthcare personnel , was obtained through a multiple choice questionnaire.

A form divided into two sectors was used for data collection:

a) The first concerns the general characteristics of the hospitals involved in relation to the management of the Covid-19 infection, the reception OUs, the data on the cases, gender, hospitalization and stay in the ICU and data related to pre and post-operative checks on the infection from Covid-19.
b) The second concerns the data relating to the infection, the characteristics of patient management, the specific diagnostic procedures, the organization of work and the outcomes of hospitalizations in terms to the presence or absence of infection. Data relating to personnel checks and the results of these checks were also entered. The follow-up of the operated patients was done by telephone interview.

The data relating to the impact of the infection on health personnel and the protection and prevention measures adopted were collected through a survey administered to OU personnel. The data obtained were divided by OU and then cumulatively aggregated and assembled into five tables. The case data were compared with those relating to the same period of 2019, and summarized in Table 1. The data relating to complications and Covid-19 diagnostics in Table 2 and 3, the organizational and management aspects of the activities and the Follow-up in Tab 4, and the data obtained from the survey administered to the staff in Tab A (Supplementary material) . The opinions expressed by the staff members regarding their safety are highlighted in Tab 5. The statistical evaluation was performed for the percentage of access to the ICU and for the Covid -19 positive tests performed in the pre and post-operative period using Fisher's Test, when appropriate assuming as a limit value for significance $\alpha = 0,05$. All the patients and healthcare staff involved in the study expressed their consent to participate.

Results

Clinical Case Histories . Out of a total of 833 patients admitted consecutively from February 1 to March 31 2020, 742 (345 male and 397 female) were operated on and enrolled in the study .Among these ,705 responded to the follow-up. In the same period of 2019 the total number of operated patients was 1187 with a decrease variously distributed among the OUs of 445 cases. The postoperative hospitalization in the ICU in 2019 was 6.5%

compared to 7.8% in 2020 (p = n.s.) with a mean hospital stay of 7.0 days in 2019 and 7.1 days in 2020. Comparing the individual OU, it emerges that there was a reduction only for VS abd Gyn in the percentage of hospitalized but an increase in the mean hospital stay. GS2 records a percentage increase in hospitalizations and mean hospital stay, as well as Ort, ES and GS3. GS1 and Neu when compared to a percentage increase in hospitalizations, recorded a decrease in the mean hospital stay. Table 1 shows the analytical data. The data relating to complications and Covid-19 tests are summarized in Table 2 and show that out of 742 patients only 13 (1.7%) performed the preoperative test, 42 (5.6%) postoperative (significance at Fisher's test for Ort (p 0.08), VS (p 0.018) and Neu (p 0.0053) and for 22 there is no reliable data. The preoperative positivity was 1 out of 13 tests and 3 out of 41 tests for postoperative.. Complications totaled 115 of which only 1 was positive Covid-19 patient. Two Oph patients tested positive in the follow up.

Organization and Diagnostics. In GS2, VS and GS3 there were Covid-19 positive patients hospitalized and patients operated on in GS1, GS2 and GS3. All OUs followed local guidelines which included swab only for symptomatic patients. A preoperative chest CT scans was performed by GS2, Ort, ES, and GS3. Only in GS3 there were surgical cases of intraoperative transmission of the infection but on patients transferred from another hospital and only in ES and GS3 there were staff members who developed symptoms and subsequently tested positive. In GS2, Ort, VS and GS3 there were positive patients who were then placed in isolation. In Ort, VS and ES, staff have not been tested for Covid-19. The reclassification of the risk was made only in GS3 while in the other OUs routine surgery was suspended, favoring emergencies and interventions considered to be of greater severity due to the pathology and characteristics of the patients. (Tab.4)

Healthcare Personnel. Data relating to the survey in which 150 doctors (97 staff members and 53 in training), 131 nurses, 10 health and social workers participated for a total of 291 interviewees are summarized in Tab A (Supplementary Material). The answers were collected for each OU and include single and multiple answers depending on the question posed. The questions relating to the protection measures made available were given multiple answers, which denote the attention given to them by all the interviewees, albeit in different ways. As regards to the questions relating to the organization of clinical and didactic activities, 61.6% of interviewees expressed the need to make changes with 14.0% believing they must completely abolish them. 70.1 % believe that the suspension of departmental meetings did not affect the quality and organization of the work. Among those who noted a qualitative change, 76.6% stated that there was less collegiality in patient management. Finally, to questions relating to personal state of mind , 87.6 % of interviewees expressed the fear of getting sick or transmitting the infection to others and 75.1 % feared transmitting the infection to their family members. In response to the question relating to the personal assessment of the adequacy of protection for staff 48.0% answered in the affirmative and 51.9 % in the negative (Tab 5).

Discussion

In accordance with previous reports (13,14), our results showed a decrease in operative activity in favor of greater complexity, the reshaping of priorities and a different use of ICU diversified according to different OUs. The need to reserve beds for Covid-19 patients has undoubtedly forced access to the ICU by shifting it towards them, without reducing the use of ICU for surgical patients. Our study shows that with the exception of VS and Gyn, the participating OUs have increased percentage of both the recourse to the ICU, which they corresponded to with the exception of GS1,

GS2 and Neu, as well as an increase in the mean hospital stays in the ICU (Tab 1). These data reflect the changes resulting from the complexity and the reassessment of patients to undergo surgery on the basis of urgency or disease severity and mainly depended on the assessments of the individual OUs rather than system provisions. The second aspect concerns the non-homogeneity of organizational behaviors, as highlighted in Table 4 and the lack of risk reshaping, on a univocal and systematic basis, If the recommendations of the Ministry of Health are excluded (Circular 7422 of 16.03.2020 containing " Address for the reshaping of the scheduled activity that can be deferred in the course of an emergency from COVID-19") it can be seen these aimed more at guaranteeing the availability of beds in the ICU rather than reclassifying the risk and complexity of the procedures. In fact, this only happened in GS3. Table 4 shows how the individual OUs had to adapt to the new situation in the absence of general guidelines to standardize their behavior. The same happened with the behavior of the surgical teams, which reflects the same lack of general rules in term of staff rotation, the conduct of department meetings and the educational activities connected to them. On this last aspect, a recent Italian study has shown how the pandemic has significantly impacted training activities and how urgent measures are needed for the reallocation of resources in this sector (15). The suspension or modification of department meetings and educational activities aimed at doctors in training took place in all participating OUs and had a negative impact, as in other situations (16), on the practice and management of the patient by doctors in training. Similarly, there was no uniform behavior with regard to infection control in patients both during hospitalization and in subsequent phases. This is due to the decision to perform diagnostic swabs, in the period under study, only on symptomatic patients, and to postpone the decision whether to perform chest CT scans in the individual OUs. Even the relative absence of post-surgical complications on Covid-19 patients compared to non-Covid-19 patients, unlike what was reported by Doglietto et al (17), is affected by this lack of information at the time of the surgical procedure and cannot be taken as a certain fact. Table 4 shows the non-homogeneity of behaviors, and highlights the lack of a central organization that has equally involved all the OUs. The third common aspect concerns the deficiency in setting up controls on hospitalized patients. The decision to carry out diagnostic swabs only for symptomatic patients does not allow heathcare providers to make an exact estimate of the incidence of the infection on hospitalized people. The only data referable to this are the swabs performed in the postoperative period which were only performed on symptomatic patients (Tab 3). The fourth common aspect, concerns the uncertainties about the spread of the infection in the hospital environment as well as the general data relating to the infection of healthcare personnel and the high number of deaths that the infection has caused among them (18). This has resulted in a strong fear of getting sick or transmitting the infection to others by the majority of staff (Tab 5). It is obvious that this, together with the other aspects relating to organizational heterogeneity, has led to a strong discomfort and emotional tension for staff, as a possible cause of a greater probability of an adverse event (19). The interviewees summarized these inconveniences (Tab 5) in assessing their own inadequate protection in 52% of cases.

The limitations of this study are represented by the partially retrospective data collection, by the non-homogeneity of organizational behaviors that do not allow general conclusions to be drawn, , in the partial non-homogeneous re-aggregation of data and in an elementary staistical analisis . However, these data allow us to draw some indicative conclusions and above all to identify some future lines of behavior to correct what happened in the early stages of the pandemic. As for future prospects, we can confirm that the Covid-19 infection affected all aspects of surgical activities (20),that there is an urgent need to address the problems induced by infection on surgical staff on a psychological level (21), and the need to develop new research directions in the surgical field (22). So, taking a cue from what was suggested by the interviewees, we can identify some further and specific

organizational improvements to supplement what has already been suggested in the seven points proposed by Brindle et al (23) to ensure greater safety and serenity for staff and greater protection of patients regarding possible contagion during hospitalization: 1) Perform diagnostic swabs for all hospitalized patients without distinction between asymptomatic and symptomatic at the time of entry and discharge; 2) Perform diagnostic swabs to all staff members with variable frequency depending on the level of spread of the infection; 3) Ensure the quantitative adjustment of the health workforce in order to ensure the necessary rest periods as well as cultural and professional study of the issues relating to the infection;4) Ensure adequate opportunities for doctors in training (24) through a reorganization, including with innovative methods on the management of surgical activities. 5) Adoption of integration and communication methodologies between professionals to be modulated both with adequate technological and individual protection devices;6) Produce shared guidelines within in-hospital pathways and in the follow-up of the operations; 7) Prepare an emergency medical and nursing unit with the possibility of self-regulation in case of recovery of a health emergency. 8) create a psychological support service for staff who express concerns about their own health or that of their relatives

Some of these strategies could be inacted by exploiting the European Community funds

Conclusion

The Covid-19 pandemic has imposed sudden changes in professional habits and organizational methods as well as in didactic and training aspects. What we have learned so far, including the mistakes made, must be used to draw useful lessons to make the appropriate changes with which we can continue to ensure the best care for patients and maximum safety for staff.

Highlights

1) The pandemic has affected clinical activities, the organizational and teaching methods of the surgical operating units and has had a negative impact on healthcare personnel

2) Healthcare institutions have shown delays and indecision in dealing with this impact, only partially obviated by the reorganization of individual OUs

3) Healthcare workers have expressed strong fear of the possibility of both active and passive contagion, and believe that they are not adequately protected

4) Actions are needed to ensure the safety of patients and surgicalstaff members.

Conflict of Interest Statement: All ofthe Authors have no conflict of interest.

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Operative Unit	Operated 2019 (2/1-3/31)	Operated 2020 (2/1-3/31)	Operated 2020 M/F	Enrolled 2020	Access ICU 2019 in %	Access ICU 2020 in %	P value	ICU length of stay (days) 2019	ICU length of stay (days) 2020
GS 1	67	48	26/22	26	5.0	8.3	0.44	9.5	9.2
GS 2	152	111	35/76	111	2.9	4.6	0.50	10	3
Gyn	88	59	0/59	59	5.0	3.0	0.70	1.2	1.5
Ort	388	159	63/96	159	0.8	1,5	0.42	6	7
ES	153	72	38/34	60	11.8	14.7	0.60	6.7	9.3
VS	113	95	62/33	95	7.1	3.1	0.22	6.7	10.6
Neu	136	95	59/36	92	5.0	8.7	0.39	10	8
Oph		24	15/9	24	0.0	0.0		0	0
GS3	90	79	47/32	79	15.0	19,1	0.66	6	7,8
Tot	1187	742	345/397	705	6,6	7,8	0.19	7.0	7,1

Tab 1. Clinical case histories

The LOS is expressed in actual median value.

Operative Unit	Total cases	Pre operative Test			Post operative Test			Covid + pre	Covid + post	Complications		Notes
		Yes	No	n.a.	si	no	n.a.			Tot.	In Covid +	
GS 1	48	1	47		3	23	22			12		
GS 2	111	2	109		1	110		1		5		
Gyn	59	1	58			59				3		
Ort	159	3	156		10	149			2	14	1	
ES	72	2	70		3	69			1	18		
VS	95	1	94		9	86				45		
Neu	95	2	93		13	82				17		
Oph	24		24			24				1		2 Covid + in follow up
GS3	79	1	78		2	77						
Tot	742	13	729		41	679	22	1	3	115	1	

Tab 2. Complications and outcome Test Covid-19

Legend : n.a. Not Available

Items	GS1	GS2	GYn	Ort	ES	VS	Neu	GS3
Covid + patients in the OU	No	Yes	NA	No	No	Yes	NA	Yes
Covid-19 + patients were operated on	Yes	Yes	NA	No	No	No	No	Yes
Asymptomatic then positive results postoperatively	No	Yes	No	Yes	No	No	No	No
Risk reclassification for Covid -19+ patients	No	No	No	No	No	No	No	Yes
Preoperative CT Scan for the operands	No	Yes	No	Yes	Si	No	No	Yes
Covid-19 Patient Testing Guidelines	Local	Local	Local	Local	No	Local	Local	National
If regional ones are present, which patients should be tested	Sintom	Sintom	Sintom	Sintom	Sintom	Sintom	Sintom	All
Type of test is performed	Swab	Swab	Swab	Swab	Swab	Swab	Swab	Swab
Isolated surgical patients	No	Yes	No	Yes	No	Yes	No	Yes
Non-surgical cases of intra-hospital transmission of Covid-19	No	No	No	No	No	No	No	Yes
Staff members who developed symptoms and tested positive in the period 1 February - 30 April 2020	No	No	No	No	Yes	No	No	Yes
The staff of the U.O. is tested for Covid-19	Yes	Yes	Yes	No	No	No	Yes	Yes
In the U.O. a plane of rotation is used	No	No	No	No	Yes	Yes	No	No

Tab 4 Patients and Staff. The table indicates the high heterogeneity of organizational behavior and personnel protection measures

Legend N.A. Not Available

	Preoperative Test			Postoperative Test					
O.U.	Yes	No	Tot	Yes	No	Tot	% Test preop	% test postop	P value Fisher T
GS 1	1	47	48	3	23	26	2,1	11,5	0,1
GS 2	2	109	111	1	110	111	1,8	0,9	1,0
Gyn	1	58	59	0	59	59	1,7	0	
Ort	3	156	159	10	149	159	1,9	6,3	**0.08**
ES	2	70	72	3	69	72	2,8	4,2	1,0
VS	1	94	95	9	86	95	1,1	9,5	**0.018**
NS	2	93	95	13	82	95	2,1	13,7	**0,0053**
Oph	0	24	24	0	24	24	0	0	
GS3	1	78	79	2	77	79	1,2	2,5	1,24

Tab 3 . Pre and post operative Tests

Legend. Ns= not significative

Question	Yes %	No %
Have you ever been afraid of getting sick or infected other people because of your job?	88	12
Have you ever been afraid to transmitt the infection to your family members?	75	25
Do you think, in general, the Staff are Adeguately protected?	48	52

Tab 5. Staff responses on level of concern and about and of personal protection

Supplementary Digital Material

Download supplementary material file: Minerva Surg-8919_Supplementary Digital Material1_V1_2021-04-12.docx