Impact of the coronavirus disease 2019 (COVID-19) pandemic on the care of patients with acute and chronic aortic conditions

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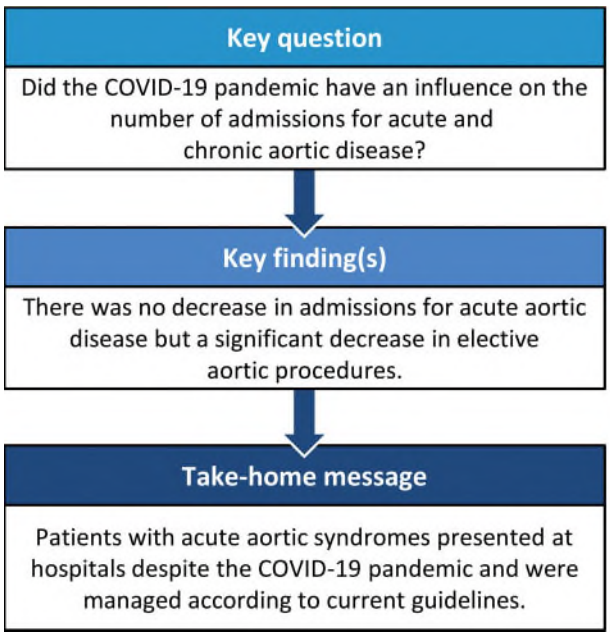

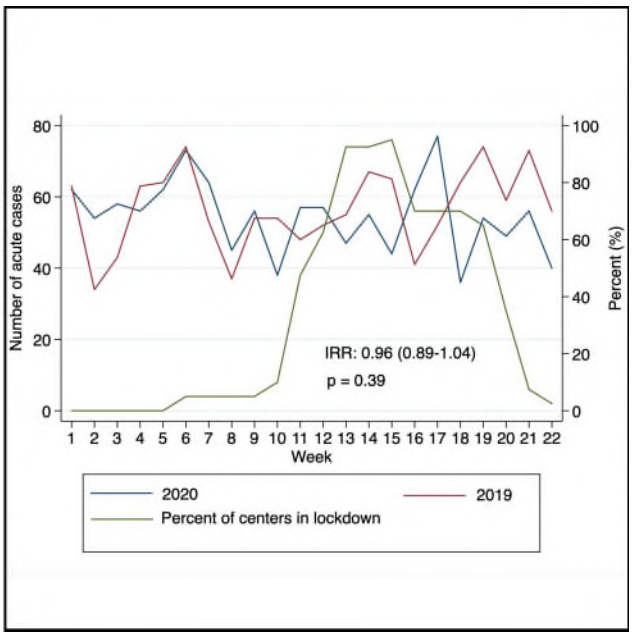

Abstract

OBJECTIVES: To evaluate the impact of the coronavirus disease 2019 (COVID-19) pandemic on acute and elective thoracic and abdominal aortic procedures.

METHODS: Forty departments shared their data on acute and elective thoracic and abdominal aortic procedures between January and May 2020 and January and May 2019 in Europe, Asia and the USA. Admission rates as well as delay from onset of symptoms to referral were compared.

RESULTS: No differences in the number of acute thoracic and abdominal aortic procedures were observed between 2020 and the reference period in 2019 [incidence rates ratio (IRR): 0.96, confidence interval (CI) 0.89–1.04; $P = 0.39$]. Also, no difference in the time interval from acute onset of symptoms to referral was recorded (<12 h 32% vs > 12 h 68% in 2020, < 12 h 34% vs > 12 h 66% in 2019 $P = 0.29$). Conversely, a decline of 35% in elective procedures was seen (IRR: 0.81, CI 0.76–0.87; $P < 0.001$) with substantial differences between countries and the most pronounced decline in Italy (-40%, $P < 0.001$). Interestingly, in Switzerland, an increase in the number of elective cases was observed (+35%, $P = 0.02$).

CONCLUSIONS: There was no change in the number of acute thoracic and abdominal aortic cases and procedures during the initial wave of the COVID-19 pandemic, whereas the case load of elective operations and procedures decreased significantly. Patients with acute aortic syndromes presented despite COVID-19 and were managed according to current guidelines. Further analysis is required to prove that deferral of elective cases had no impact on premature mortality.

Keywords: Acute and elective thoracic and abdominal aortic procedures • Coronavirus disease 2019 pandemic

ABBREVIATIONS

ACS	Acute coronary syndromes
CI	Confidence interval
COVID-19	Coronavirus disease 2019
IRR	Incidence rates ratio
TIA	Transient ischaemic attack

INTRODUCTION

During the initial wave of the coronavirus disease 2019 (COVID-19) pandemic, a substantial decrease in the admission rates of patients with acute coronary syndromes (ACS) and consequently, a sharp decline in the number of emergency coronary procedures performed in Europe and the USA, were observed [1–3]. In several European countries, the nationwide lockdown severely restricted movement, which might have contributed to this phenomenon on top of the widespread fear of contracting COVID-19 when admitted into a hospital [4]. There is substantial concern that similar trends will be observed in the setting of acute aortic syndrome (aortic dissection) with a substantial death toll, if not managed swiftly.

The aim of this study was to evaluate the impact of the COVID-19 pandemic on acute and elective thoracic and abdominal aortic procedures and to compare the data with the same period in 2019 in participating institutions.

PATIENTS AND METHODS

Patients

The study was registered at the ethics committee—Albert-Ludwigs-University Freiburg under the reference ID: 20-1025. Forty departments from Europe, Asia and the USA that provided services for acute and chronic aortic conditions contributed and shared their data on the number of acute and elective thoracic and abdominal aortic procedures performed between January and May 2020 and between January and May 2019. Only the number of procedures for acute and chronic aortic conditions, further divided into thoracic and abdominal procedures, without any patient-related information was collected. Figure 1 shows the

Figure 1: Location of the participating departments (source: google maps).

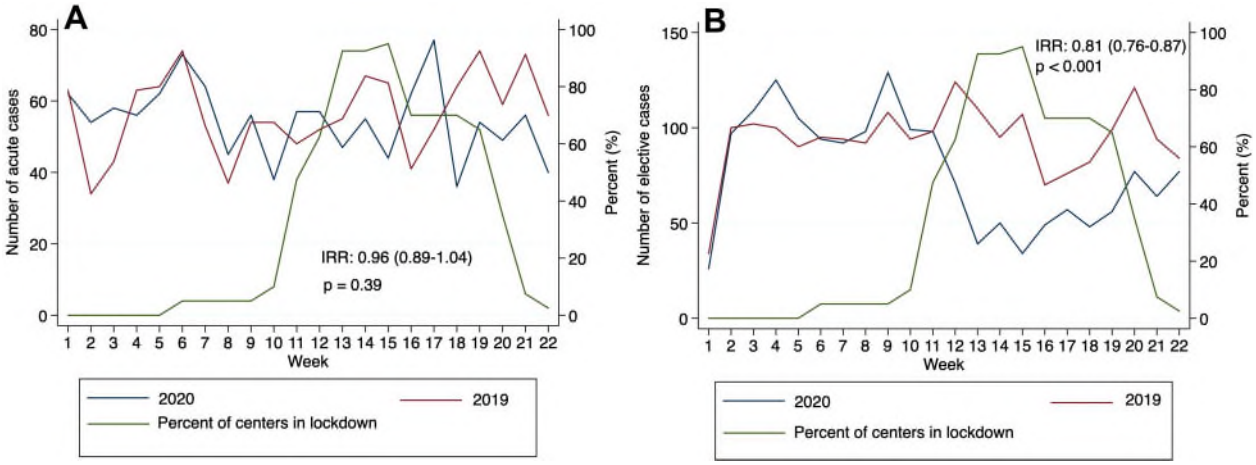

Figure 2: (**A**) Acute aortic cases—Europe, Asia, USA. (**B**) Elective aortic cases—Europe, Asia, USA.

Table 1: Acute and elective cases per week—2020

Week	Total cases	Total acute cases	Acute >12 h	Acute <12 h	Total elective cases
1	88	62	23	39	26
2	151	54	23	31	97
3	167	58	21	37	109
4	181	56	20	36	125
5	167	62	19	43	105
6	167	73	17	56	94
7	156	64	21	43	92
8	143	45	15	30	98
9	185	56	17	39	129
10	137	38	10	28	99
11	155	57	15	42	98
12	128	57	20	37	71
13	86	47	20	27	39
14	105	55	14	41	50
15	78	44	16	28	34
16	111	62	17	45	49
17	134	77	27	50	57
18	84	36	9	27	48
19	110	54	18	36	56
20	126	49	13	36	77
21	120	56	19	37	64
22	117	40	13	27	77

location of the participating departments. Figure 1 was generated with google maps.

Definitions

Thoracic aortic pathology comprised any pathology beginning at the proximal thoracic aorta with treatment of the disease is usually limited to the thoracic aorta but also extending down to the abdominal aorta (e.g. type A, type non-A-non-B and type B aortic dissection). Abdominal aortic pathology refers to any pathology below the diaphragm and involving the abdominal aorta with or without the iliac arteries. Acute aortic pathology indicates any pathology requiring urgent or emergency treatment, whereas a chronic aortic pathology was present when treatment could be deferred to an elective setting.

Data collection

A template excel file was sent to all participating aortic centres with the request to share their number of procedures partitioned in calendar weeks [1–22] in 2020 and 2019. In addition, in acute cases, we retrieved the time between onset of symptoms and referral for treatment. Data were systematically retrieved from institutional databases for cardiac and vascular care units.

Statistical methods

The cases are presented as weekly recorded numbers in all centres. Incidence rates ratios (IRRs) were calculated by using Poisson regression analysis. The IRRs are presented with 95% confidence intervals (CIs). Statistical analysis was performed using R version 3.6.1 for macOS (The R Foundation for Statistical Computing, Vienna, Austria) with a level of significance set at *P*-value <0.05.

RESULTS

Acute and elective aortic cases in Europe, Asia, the USA

No difference in the number of acute aortic cases could be observed between 2020 and 2019 (IRR: 0.96, CI 0.89–1.04; $P = 0.39$), Fig. 2A. A significant decrease of 35% in elective cases was seen (IRR: 0.81, CI 0.76–0.87; $P < 0.001$), Fig. 2B. Table 1 shows the number of acute and elective cases per calendar week in 2020 and stratifies the acute cases in <12 and >12 h between onset of symptoms and referral for treatment. Table 2 shows the number of acute and elective cases per calendar week in 2019 and stratifies the acute cases in <12 and >12 h between onset of symptoms and referral for treatment.

Acute and elective aortic cases—Europe

No difference in the number of acute aortic cases could be observed between 2020 and 2019 (IRR: 0.94, CI 0.86–1.03; $P = 0.25$), Fig. 3A. A decrease in elective cases was seen (IRR: 0.81,

CI 0.75–0.87; $P < 0.001$) as shown in Fig. 3B. In Figs 2–3, we additionally added the percentage of the centres being affected by the lockdown per week by retrieving these data from https://en.wikipedia.org/wiki/COVID-19_pandemic_lockdowns where the exact time points and durations of lockdowns are documented. Figure 4 shows the changes in acute cases in Europe according to country, where no significant decrease could be observed in Italy (decrease by 11%, $P = 0.29$) and Austria (decrease by 9%, $P = 0.49$). In Switzerland (increase by 9%, $P = 0.36$) and Poland (increase by 20%, $P = 0.36$), a non-significant increase in acute cases could be observed. Germany was the only country where a significant decrease in acute cases was seen (decrease by 22%, $P = 0.006$). Figure 5 shows the changes in elective cases in Europe according to country, in which Italy (decrease by 40%, $P < 0.001$), Austria (decrease by 20%, $P = 0.03$) and Poland (decrease by 26%, $P = 0.02$) showed a significant decrease, whereas the decrease was non-significant in Germany (decrease by 6%, $P = 0.41$). On the other hand, Switzerland showed an increase in elective cases as compared to 2019 (increase by 35%, $P = 0.02$).

Table 2: Acute and elective cases per week—2019

Week	Total cases	Total acute cases	Acute >12 h	Acute <12 h	Total elective cases
1	97	63	26	37	34
2	134	34	10	24	100
3	145	43	14	29	102
4	163	63	20	43	100
5	154	64	23	41	90
6	169	74	20	54	95
7	147	53	23	30	94
8	129	37	16	21	92
9	162	54	17	37	108
10	148	54	15	39	94
11	146	48	16	32	98
12	176	52	20	32	124
13	165	55	19	36	110
14	162	67	23	44	95
15	172	65	22	43	107
16	111	41	13	28	70
17	128	52	15	37	76
18	146	64	25	39	82
19	173	74	19	55	99
20	180	59	19	40	121
21	167	73	29	44	94
22	140	56	14	42	84

Time between onset of symptoms and referral

In acute cases, no difference regarding the time interval from acute onset of symptoms to referral was recorded (< 12 h 32% vs > 12 h 68% in 2020, < 12 h 34% vs > 12 h 66% in 2019) $P = 0.29$ (Fig. 6).

DISCUSSION

There was no change in the number of procedures for acute thoracic and abdominal aortic pathologies during the initial phase of the COVID-19 pandemic whereas, due to the provision of intensive care capacity for potential COVID-19 patients, a decrease in elective thoracic and abdominal procedures was observed. The burden of aortic pain seems to outperform the reluctance to seek medical attention which is reflected in a similar time interval between onset of symptoms and referral, when compared with the pre-COVID-19 times.

In comparison to other cardiovascular pathologies, such as ACS, the incidence of acute aortic syndrome and the prevalence of chronic thoracic and abdominal aortic pathologies are low.

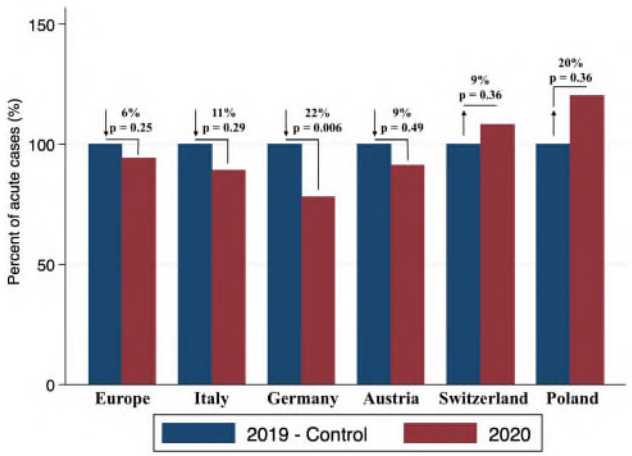

Figure 4: Changes in acute cases in Europe according to country.

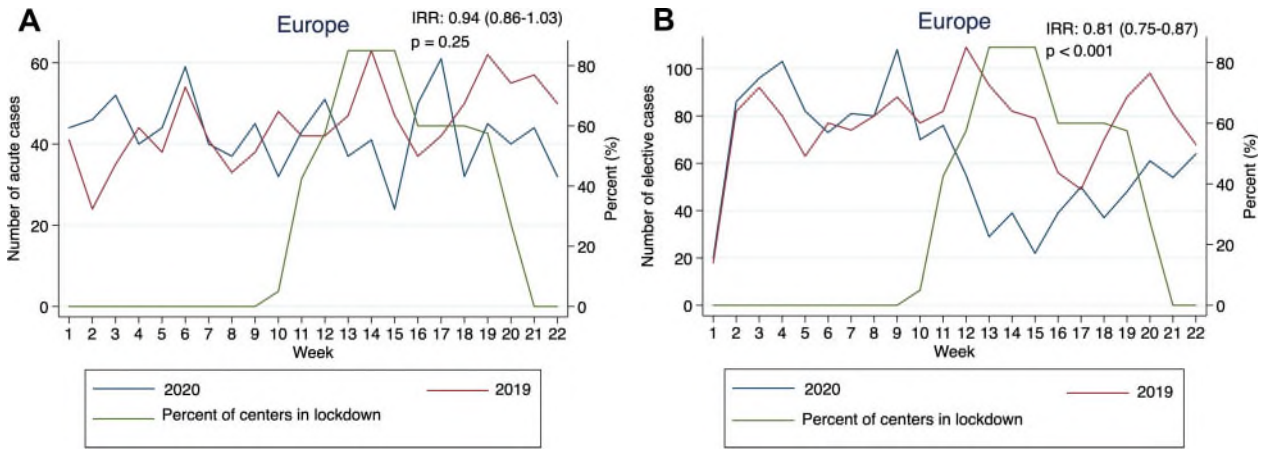

Figure 3: (**A**) Acute aortic cases—Europe. (**B**) Elective aortic cases—Europe.

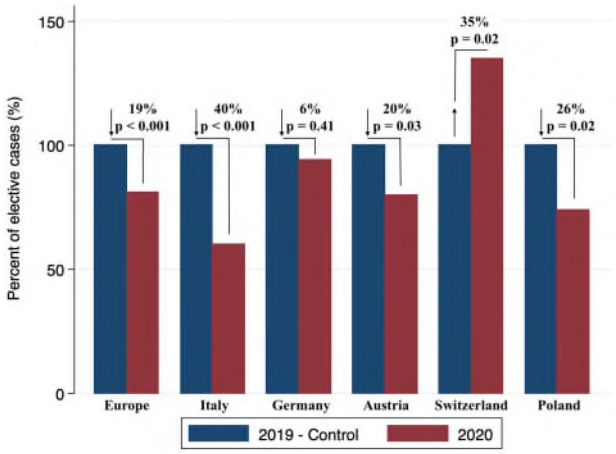

Figure 5: Changes in elective cases in Europe according to country.

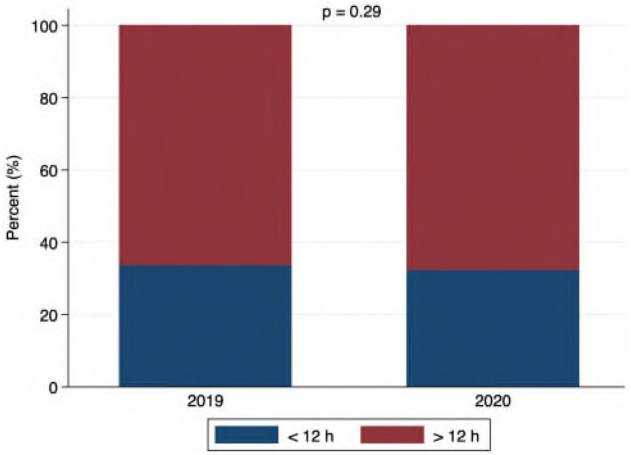

Figure 6: Time interval from acute onset of symptoms to referral.

However, pooling data from 40 institutions affected by the pandemic may enable a robust analysis on a representative cross-section of the current situation in 3 continents. Interestingly, even in 2020 (under pandemic conditions), the overall number of acute cases remained unchanged. This finding might well be attributed to the fact that symptoms from acute aortic syndromes are so striking, that the potential reluctance to seek medical advice, which has been reported in other types of cardiovascular disease such as ACS, is overridden by the urge to seek medical help [5]. This is also backed by a German analysis on admissions for acute myocardial infarction, acute limb ischaemia, aortic rupture, stroke or transient ischaemic attack (TIA) between 1 January 2019 and 31 May 2020 that found a decline in admissions between 9% and 15% for all other conditions but no decline in admissions for aortic rupture [6].

There was a substantial decrease in elective cases in particular between calendar Week 11 and 15 which can be clearly related to nationwide lockdown in most countries and a reduction in elective surgical procedures in order to be able to preserve intensive care capacity for potential COVID-19 patients [7]. As this expected increase in ICU admissions for COVID-19 patients did not occur in many settings, these measures were gradually eased, enabling the resumption of treatment for elective patients.

This exact same pattern could be observed when focusing on various European centres in this report. However, some differences were observed between European countries with regard to both acute and elective procedures. Regarding acute cases, stable conditions could be observed in Italy, Austria, Switzerland and Poland with little fluctuations. Germany was the only country where a significant decrease was observed, in particular between Calendar week 14 and 22. Currently, the reasons remain speculative but reluctance of patients to seek advice or a natural undulation in the incidence might be causative [8]. But in some epicentres of the COVID-19 pandemic a dramatic decrease in patients treated for acute aortic disease could also be seen [9, 10].

The decrease in elective cases in Europe was substantial with 2 exceptions, Germany where conditions were stable, and Switzerland where even an increase in elective cases was observed. The reason here might well represent the fact that one department of vascular surgery was recently newly established—which makes a difference in a small country and referrals were increasing there despite the COVID-19 pandemic. Another reason might well be the adherence to guidelines as well as the newly developed knowledge that even patients with diameters having just crossed the threshold to indication already have a substantial yearly risk of sustaining an acute aortic event, which justifies timely treatment [11]. Finally, the net numbers per country could well explain fluctuations in both directions which refer in particular to smaller countries. This is reasonable, as an acute aortic event on top of a chronic aortic condition will substantially impact immediate as well as long-term outcome [12]. Finally, hospital strategies play a decisive role in this rapidly changing environment. However, as national rules regarding the provision of care for potential COVID-19 patients—at least in the countries participating in this project—have been very similar, we would not expect an effect in this regard on our results.

Interestingly, the time between onset of symptoms and referral in acute cases showed no difference, which is in contrast to a very recent analysis on symptom-to-hospital analysis in ST-elevation myocardial infarction patients in the UK, where a decrease in number of procedures and an increase in the time interval to hospitalization were observed [13]. Here, it seems obvious that typical aortic syndrome is such a devastating clinical event that patients will seek medical advice regardless of circumstances (as long as hospitals provide acute aortic care) and that the need and provision of acute aortic care and emergency operations is independent of any pandemic and should always be an option.

Limitations and strengths

This report lacks nationwide reporting but is the first of its kind to analyse referral pattern in the setting of the COVID-19 pandemic by data sharing of several high-volume cardiovascular referral centres from 3 continents, which provided a unique opportunity to obtain insight into this complex and dynamic topic. It has to be clearly stated that the low number of centres contributing from outside of Europe might therefore not reflect the actual situation in the respective regions or countries. Finally, conservative management of aortic diseases is expected to have increased during the pandemic. This may be related to restrictions on the resources or to a decreased use of health facilities by

patients with symptoms, although these data cannot be mirrored by this analysis.

CONCLUSION

In summary, there was no change in the number of procedures in acute thoracic and abdominal aortic pathologies during the initial phase of the COVID-19 pandemic whereas, due to the provision of intensive care capacity for potential COVID-19 patients, a decrease in elective thoracic and abdominal procedures has been observed. The burden of aortic pain seems to exceed the reluctance to seek medical advice which is additionally reflected in an unchanged time interval between onset of symptoms and referral. The need for acute aortic care is unchanged in a pandemic and resources are to be secured.

Conflict of interest: none declared.

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