Minimal impact of COVID-19 outbreak on the postoperative morbidity and mortality following emergency general surgery procedures: results from a 3-month observational period

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ABSTRACT

Aim The outbreak of the COVID-19 pandemic has had a major impact on the delivery of elective, as well as emergency surgery on a world-wide scale. Up to date few studies have actually assessed the impact of COVID-19 on the postoperative morbidity and mortality following emergency gastrointestinal surgery. Herein, we present our relevant experience over a 3-month period of uninterrupted provision of emergency general surgery services in George Eliot Hospital NHS Trust, the United Kingdom.

Methods We performed a retrospective analysis of a prospective institutional database, which included the operation types, paraclinical investigations and postoperative complications of all patients undergoing emergency general surgery operations between March – May 2020.

Results The occurrence of a 5% overall respiratory complication rate postoperatively, with 3% infection rate for COVID-19 was found; no patient had unplanned return to intensive care for ventilator support and there was no mortality related to COVID-19 infection.

Conclusion When indicated, emergency surgery should not be delayed in favour of expectant/conservative management in fear of COVID-19-related morbidity or mortality risks.

Key words: emergency, SARS-CoV-2, surgery
INTRODUCTION

Following the initial infection wave from COVID-19 in China in 2019, the European health services started to become affected during the first months of 2020, altering in many aspects the delivery of emergency medical and surgical care (1). With respect to the provision of acute care surgery, the options of delaying the definitive operative management can lead to dramatic increase of the morbidity and mortality, in contrast to elective operations, most of which can be postponed with relatively low risk for the patients (2). During these last months, most of the main scientific bodies and surgical societies have issued relevant guidance regarding the aspects of provision of acute care surgery, focusing on patient and personnel safety (3,4). With the scientific community still in the process of understanding the disease process and its system-specific implications, acute care surgery services inevitably have to continue to function; therefore, it is of paramount importance to assess the true impact of the COVID-19 pandemic on the emergency surgery postoperative outcomes. Up to date, there are only few clinical studies and case series addressing the impact of the COVID-19 infection on the emergency surgery postoperative outcomes with variable results (5,6).

Aim of this study was to present our experience relating to COVID-19-associated postoperative morbidity and mortality after emergency gastrointestinal surgery over a 3-month period, between March-May 2020, during which our centre provided continuous emergency general surgery services.

PATIENTS AND METHODS

Patients and study design

We reviewed retrospectively all general surgery emergency operations performed between 01 March–31 May 2020 in George Eliot Hospital NHS Trust using the relevant software from our dedicated emergency theatre.

A total of 103 patients were identified, of which three patients were excluded from the outcome analysis, as they were still inpatients at the time of the analysis (all three tested negative via RT-PCR on admission for COVID-19, with no respiratory complications to date). Our final sample consisted therefore of a total of 100 patients.

We reviewed the patients’ demographics, type of performed surgery, the overall in hospital length of stay, the duration of hospitalisation and possible readmission to intensive care, as well as the occurred postoperative complications and assessed the existence of potential correlation between those parameters and suggested infection from COVID-19. Our study did not influence the patient care, hence no approval from our institutional ethical committee was required.

Methods

Screening for COVID-19 infection on the acute surgical admissions depended on the presence of concurrent symptomatology, as well as the current institutional guidance at the time of patients’ admissions, which was updated at least twice per month. Our policy to assess the COVID-19 patient status included a combination of oropharyngeal swabs, which was analysed with real-time polymerase chain reaction (RT-PCR), and uncontrasted computed tomography (CT) of the chest.

All patients that clinically were likely to undergo a laparotomy and require postoperative admission to our Intensive Care Unit, had a completion CT chest along with the performance of abdominopelvic CT that was requested during the diagnostic workup for their presenting acute surgical pathology. Those additional thoracic CT scans were performed and reported by a Consultant Radiologist within our institution and the analysis of RT-PCR specimens was performed in our institution as well, with average time of results release fluctuating between 48 – 72 hours from admission.

RESULTS

A total of 100 patients were analysed, of which 56 (56%) were females and 44 (44%) males, with an age span between 17-88 years (mean age 55.6 years). With respect to the type of surgery performed, out of 100 patients, 32 underwent a laparoscopic procedure, 65 had upfront open surgery and 3 were laparoscopic converted to open cases. In detail, the following procedures were undertaken: 26 appendicectomies (24 laparoscopic, 2 laparoscopic converted to open), 22 emergency laparotomies, 14 open hernia repairs (9 inguinal, 2 umbilical, 1 obturator, 1 femoral, 1 Spigelian), 10 cholecystectomies (9 laparoscopic, 1 open), 10 cholecystectomies (9 laparoscopic, 1 open), 25 abscess requiring drainage under general anaesthesia (13 anorectal, 12 on trunk), 2 examinations of the anorectum under general anaesthesia with no additional procedure and fi-
Subsequently tested positive.

who was not tested with swabs on admission, su-

negative swab re-tested positive and one patient

seven) being positive (two patients with initially

ratory symptomatology, with only three (out of

postoperative period, chest CT scans were

ptalisation, was re-tested positive).

rative swabs were taken in 49% of emergency

with respect to swabs for RT-PCR, pre-ope-

rative complications, two (out of five) had swabs positive

for COVID-19 in the post-operative period (ad-

missions swabs negative) and the one patient who

had a positive swab postoperatively was minimally

negative swab for COVID-19 and during the hos-

hospitalisation, was re-tested positive).

With respect to swabs for RT-PCR, pre-op-

rative swabs were taken in 49% of emergency

admissions and all were reported as negative. Postopera-

tive swabs were taken in seven (7%) patients upon develop-

ment of suspicious respiratory symptomatology, with only three (out of seven) being positive (two patients with initially negative swab re-tested positive and one patient who was not tested with swabs on admission, subsequently tested positive).

Table 1. Characteristics of the 11 patients with non-respiratory postoperative complications

<table>
<thead>
<tr>
<th>Primary procedure</th>
<th>Type of complication</th>
<th>Management</th>
<th>Overall LOS (days)</th>
<th>ITU LOS (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laparoscopic converted to open appendicectomy</td>
<td>Intra-abdominal collection</td>
<td>Antibiotics</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>Laparotomy and adhesiolysis (no resection)</td>
<td>Urinary tract infection</td>
<td>Antibiotics</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Laparoscopic converted to open appendicectomy</td>
<td>Intrabdominal collection</td>
<td>Antibiotics</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Laparotomy and right hemicolectomy</td>
<td>Pulmonary emboilsion</td>
<td>Therapeutic anticoagulation</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Open suture repair of obturator hernia</td>
<td>Central line and wound infection</td>
<td>Antibiotics</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Laparoscopic appendectomy</td>
<td>Urinary tract infection</td>
<td>Antibiotics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Open suture repair of inguinal hernia</td>
<td>Acute coronary syndrome</td>
<td>Therapeutic anticoagulation</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Laparoscopic cholecystectomy</td>
<td>Intrabdominal collection</td>
<td>Antibiotics</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Open nesh repair of Spigelian hernia</td>
<td>Pulmonary embolism</td>
<td>Therapeutic anticoagulation</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Laparotomy &amp; Hartmann’s procedure</td>
<td>Wound infection / Intra-abdominal collection</td>
<td>Antibiotics</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Laparotomy and defunctioning ostomy</td>
<td>Cardiac arrythmia / Intra-abdominal collection</td>
<td>Medical therapy, antibiotics</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

*Mean overall LOS 10.6 days, mean ITU LOS 0.6 days LOS, length of stay; ITU, Intensive Therapy Unit

nally 1 diagnostic laparoscopy, which was con-

verted to open right hemicolectomy.

Overall, 35% of the admitted patients had pre-

operatively a chest CT scan, with none sugge-

tive of typical COVID-19 related changes. In the

postoperative period, chest CT scans were

requested for four patients, with only one demon-

strating changes in consistency with COVID-19

infection (the particular patient had an initially

negative swab for COVID-19 and during the hos-

pitalisation, was re-tested positive).

With respect to swabs for RT-PCR, pre-

operative swabs were taken in 49% of emergency

admissions and all were reported as negative. Postopera-

tive swabs were taken in seven (7%) patients upon develop-

ment of suspicious respiratory symptomatology, with only three (out of seven) being positive (two patients with initially negative swab re-tested positive and one patient who was not tested with swabs on admission, subsequently tested positive).

Regarding the postoperative outcomes, mortality rate was 1%, with this single death occurring due to decompensated organ failure on the first postope-

rative day after emergency laparotomy for intestinal

obstruction, with the patient having substantial

cardiac comorbidities and frailty. It has to be noted

that the patient was not tested for COVID-19 either

with swab or CT chest, as this was not the protocol

at the time of her admission (first week of March).

Overall our morbidity rate was 16%, with 11 (out of 16) patients who had non-respiratory postoperative complications (Table 1). Concerning the five

patients who developed respiratory postoperative

complications, two (out of five) had swabs positive

for COVID-19 in the post-operative period (ad-

missions swabs negative) and the one patient who

had a positive swab postoperatively was minimally

symptomatic from the respiratory aspect (no pre-

operative swab taken) (Tables 2, 3).

No re-operation was required for any of the patients

and there was no unplanned re-admission to our in-

Table 2. Characteristics of the five patients with respiratory postoperative complications

<table>
<thead>
<tr>
<th>Primary procedure</th>
<th>Type of complication</th>
<th>Management</th>
<th>Swab for COVID</th>
<th>Chest imaging</th>
<th>Overall LOS (days)</th>
<th>ITU LOS (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incision and drainage of back abscess Known COPD patient / NIV at home</td>
<td>Respiratory failure</td>
<td>Planned non-invasive ventilation on ward &amp; antibiotics</td>
<td>Not tested pre/post-operatively</td>
<td>No essay performed</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Laparoscopic cholecystectomy</td>
<td>Respiratory tract infection</td>
<td>Antibiotics</td>
<td>Pre-op swab negative, post-op swab after symptoms positive</td>
<td>Pre-op CT chest: non-specific changes Post-op CXR: B/L infiltrates, in consistency with COVID-19</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Laparoscopic cholecystectomy Respiratory tract infection / Pulmonary embolism</td>
<td>Antibiotics / Therapeutic anticoagulation</td>
<td>Pre-op swab negative, post-op swab after symptoms positive</td>
<td>Pre-op CT chest: non-specific changes Post-op CXR: B/L infiltrates, in consistency with COVID-19</td>
<td>26</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Laparotomy &amp; Hartmann’s procedure</td>
<td>Respiratory tract infection</td>
<td>Antibiotics</td>
<td>Pre-op swab negative, post-op swab after symptoms negative</td>
<td>Pre-op CT chest: negative Post-op CXR: non-specific changes</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Laparotomy and repair of perforated duodenal ulcer</td>
<td>Respiratory tract infection</td>
<td>Antibiotics</td>
<td>Not tested pre/post-operatively</td>
<td>Pre-op CXR: negative Post-op CXR: non-specific changes</td>
<td>18</td>
<td>2</td>
</tr>
</tbody>
</table>

Mean overall LOS 17.6 days, mean ITU LOS 1.2 days LOS, length of stay; ITU, Intensive Therapy Unit; COPD, chronic obstructive pulmonary disease; CXR, chest X-ray; B/L, bilateral; NIV, non-invasive ventilation
tensive care unit for ventilator support. Although we had only 3% patients who were tested positive for COVID-19, these patients had a longer duration of hospitalisation compared to the entire cohort as well as when compared to the subgroup of patients with postoperative morbidity (Tables 1, 2).

DISCUSSION
The impact of COVID-19 pandemic has drastically led to a substantial change of the prioritisation with respect to elective general surgery procedures, mainly through application of local protocols allowing only the performance of operations that need by default to be performed on expedited basis, such as for cases of gastrointestinal malignancies. In the elective context though, since the procedure and perioperative care can be planned in advance, the patients can follow self-isolation protocols and screening for COVID-19 can be performed at convenient stage, allowing the surgical teams to amend the admission and care plans if the patients test positive for COVID-19 and minimise associated postoperative risks (7).

On the contrary, when it comes to emergency general surgery, even if the patients get screened for COVID-19 during their admission time, these results usually get released 48-72 hours later, fact which obliges the acute care surgeons to make judgment calls about operative versus conservative treatment of these patients without evidence regarding their COVID-19 infection status (8).

REFERENCES


Model "P" in gender prediction based on the mastoid process

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ABSTRACT

Aim To determine the degree of accuracy in determining the sex of the skull based on classical morphometric analysis of the mastoid process. Morphometric analysis excluded a subjective approach expressed in osteoscopic analysis.

Methods The study was conducted on a sample of 100 macerated skulls of known gender and age from the second half of the 20th century, including the Bosnian population. Of the 100 skulls, 50 (50%) were male and 50 (50%) were female. Male skulls were on average 60 (47-71) years old and female 57 (43-76) years old. At each mastoid process, 3 measurements were made: mastoid length, mastoid width (medio-lateral diameter) ML and anteroposterior diameter (AP) of the mastoid process.

Results Using the univariate method, we found a significant difference between length, width, AP diameter and size of mastoid processes as well as between gender (p<0.05). Multivariate binary logistic regression showed statistically significant differences in AP diameter of the mastoid process (p<0.05).

Conclusion The created model "P" ("P"=exp [X]/1+exp [X]) for sex determination based on mastoid process showed sensitivity of 82% correct prediction for female skulls and 65% accurate prediction for male skulls. This discourse with respect of population standards grants most effective anthropological proof and as such may be suggested for forensic expertise based on human skull.

Key words: differentiation, quantitative analysis, skull, sex
INTRODUCTION
Skeletal sex determination is the process of determining whether a skeleton or parts of a skeleton are from a male or a female. The skeleton is used because after death bones are preserved for the longest period of time, and there are no significant changes that would lead to erroneous findings (1). Almost all bones show some degree of sexual dimorphism (2). For secure identification of gender and other identity indicators it is ideal if there is an intact, complete skeleton (3). However, due to a variety of circumstances, both natural and artificial, often only parts of the skeleton are found (4). The accuracy of gender determination is highest in pelvic analysis, however, pelvis itself is not always available for analysis (5). The skull is therefore considered the second best option for sex determination (6).

The anatomical and morphological structures of the skull used for the purpose of sex determination are numerous: the frontal bone (position of squamous part, the appearance of the supraciliary arch, the sharpness and shape of the orbit), the zygomatic bone (presence of marginal tubercle on the frontal process), the temporal bone (size and shape of the mastoid process, width of the zygomatic processes), the occipital bone and mandible (angle between body and mandible ramus – angle of mandible), shape of nasal root, muscular insertions on bones, tooth size and face shape (7). Osteoscopy and classical skull morphometric analysis can determine the sex with an accuracy of 92%, and if only the mandible is analysed the accuracy is estimated at 90% (8,9). Over time, many studies have shown that gender can be determined based on the human skeleton, especially by examining the pelvis and skull (9). Thus, different methods have been refined over time, and today, in addition to visual identification of sexual characteristics, various univariate and multivariate statistical analyses are used, leading to discriminant functional analyses (10,11). History of the development of skeleton-based sex determination shows its developmental dynamics from osteoscopic determinations to osteometric ones, which additionally inherits the application of sophisticated mathematical-statistical methods (9).

The aim of our study was to determine a degree of accuracy in determining the sex based on mastoid process by using multivariate binary logistic regression.

MATERIALS AND METHODS

Materials and study design
The study was conducted at the Department of Anatomy, School of Medicine, University of Sarajevo, in the period February to June 2019. The study was performed on a sample of 100 macerated and degressed skulls of known gender and age from the second half of the 20th century, including the Bosnian population, and which belong to an osteological collection of the Department of Anatomy, School of Medicine, University of Sarajevo. The average age of the skull was 58.4 years. Of the 100 skulls, 50 (50%) were male with an average age of 60 (47-71) years, while 50 (50%) were female with an average age of 57 (43-76) years. A sample of 100 whole human skulls (50 males and 50 females) were randomly selected from a total sample of 211 skulls (139 males and 72 females).

Methods
It was an osteometric study, where 3 diameters of the mastoid process were measured on each skull using a slider (Schubler; GPM Swiss Made) on both sides. The size of the mastoid process was calculated by a given formula.