Original Article

Characteristics and Outcomes of 1220 Patients with SARS-Cov-2 Infection Hospitalized in Central Tuscany Area (Italy): New Models of Hospital Management during the Phase 1 of Covid-19 Emergency

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INTRODUCTION

Central Tuscany Local Health Authority (CT-LHA) is born in 2016 by merging of four former LHAs, each of them covering a district based on a big/medium town (Florence, Pistoia, Prato, Empoli) [1,2]. Currently, this organization, headquartered in Florence and including 13 hospitals and 220 territorial health structures, manages health services for over 1.600,000 inhabitants living in this large area [3]. CT-LHA is the largest health authority in Tuscany, where health services are also provided by two other LHAs (Northwest and Southeast LHA) and 3 university centers located in the cities of Florence, Siena and Pisa. For the extension of its territory and the number of patients managed, CT-LHA can be considered one of the most important and widespread in Italy.

Following World Health Organization (WHO) declaration of public health international emergency due to Covid-19 (30/01/2020) [4] and National Declaration of health emergency (31/01/2020) [5], Tuscany started to organize “ad hoc” strategies to counteract SARS-CoV-2 epidemic outbreak.

Only seven of the 13 hospitals, according to their characteristics, structures, organization and ability to manage severe emergencies, were chosen and reorganized to treat Covid-19 patients. Consequently, Hospital departments not directly involved in Covid-19 treatment, underwent to a severe reduction, reorganization and optimization of human and structural resources.

At first, the seven Covid-19 hospitals managed the incoming cases using the normal amount of beds of each operating unit; as the emergency spread through the area and the number of cases rapidly raised, new Covid-19 positive areas were created. At the peak of the infection (in central Tuscany around the first week of April) [6], 582 medical ordinary beds, outside Intensive Care Units (ICU), were used and the strategy was focused on the institution of high care medical setting with the possibility of Non Invasive Ventilation (NIV).

So far, limited information is available describing the clinical presentation and outcomes of patients requiring hospitalization for Covid-19 disease. In the literature, morbidity and mortality resulted higher in male population [7,8].

Goal of this analysis is the description of the features and outcomes of patient with Covid-19 recovered in CT-LHA hospitals, in not ICU medical settings, between 24/02/2020 and 18/05/2020, that is the date of the end of pandemic phase 1, according to Regional regulation n. 56 - 57/2020 [9,10].

MATERIALS AND METHODS

All consecutive patients who required hospital admission in non-ICU beds, in one of the seven hospitals with Covid-19 specific setting, between 24/02/2020 and 18/05/2020, with severe acute respiratory syndrome related to SARS-CoV-2 infection, confirmed by positive result on polymerase chain reaction testing of a nasopharyngeal sample, were included.

Data have been extracted from CT-LHA’s IT database. All hospitalizations have been tagged with diagnostic code 078.89, according with Health Ministry indications [11], describing SARS-CoV-2 infection. To ensure the completeness of data, each hospital carried out a check of computerized medical records, adding the diagnosis code if missing. Data collected by each hospital, concerning patient demographic information and outcomes, including lengths of hospitalization, discharge and mortality, were processed and analyzed. Length of hospitalization was considered from the admission to discharge or time of death or the end of the study period, without including stay in emergency department.

RESULTS

Total amount of hospitalizations was of 1220, splitted among 7 hospitals in the percentages shown in table 1. Case distribution reflects quite faithfully the ordinary geographic distribution of the population. Florence area with its 4 hospitals ordinary collects 51% of CT catching area and has recorded 48% of total hospitalizations during Covid-19 emergency. Small spreads were shown in Pistoia hospital where ordinary collection is 18% of the CT catching area and has recorded 24% of total hospitalizations in the same period; the same happened in Empoli hospital whose catching area is ordinary around 15% and recorded only 10% of hospitalizations.

Average age of hospitalized patients was 71.9 years (Table 2); differences related to gender show that 652 were male (53% of the total, average age 69.1) versus 568 females (47% of the total, average age 75.1). Average length of stay for the total amount considered was 12.8 day with no difference between genders.
The total amount of deaths in the considered period was 252, 21% on total hospitalized patients (Table 1). Among 252 dead patients, 144 were male (22% of total hospitalized males) and 108 were female (19% of total hospitalized females). Average age of died patients was 81.6 years after an average length of stay in hospital of 9.7 days. On a gender base analysis, average age was 65.5 years in males and 75.4 years in females; no significant differences in average length of stay, distribution about age and gender, were recorded in the study data, concerning hospitalization, discharge, mortality, length of stay, and too many other countries around the world [7]. In the present study data, concerning hospitalization, discharge, mortality, length of stay, distribution about age and gender, were recorded in the period between February 24, 2020 and May 18, 2020, in 7 hospitals managed by CT-HLA and dedicated to receive and treat patients with SARS-Cov2 infection. The total amount of hospitalizations in the 7 different hospitals reflects the geographical distribution of the population, thus confirming a homogenous virus transmission on the whole CT-LHA area. Recorded difference between hospitalizations (24%) and catchment area (18%) in Pistoia could be explained by an infective cluster developed in this area. Empoli’s performance, on the contrary, could be explained by a lesser virus circulation in this area. Both hypotheses need specific focuses and thorough investigations to be confirmed.

We observed an inversion in male/female hospitalization ratio compared to general population, usually greater for females (52% vs 48%); this is significant for a typical clinical expression of the viral infection in males, needing a greater frequency of hospital assistance and hospitalization than in females. Considering the deaths' outputs, we can affirm again that this virus is responsible of more aggressive symptoms in male patients and a worst prognosis compared to female patients. Differences in age reflects again differences recorded in total hospitalizations and in population too and this distribution is similar to that reported from China and USA [7,8].

San Giovanni di Dio Hospital (Florence) has recorded an average age (75.4 years) higher than in the other hospitals and overall in CT-LHA; this is probably related to the fact that people living close to this hospital and attending its services is the oldest in the area, CT-LHA; this is probably related to the fact that people living close to this hospital and attending its services is the oldest in the area, having a life expectation of 82.4 years from birth versus 81.6 years of average age in CT-LHA. For the same reason also a longer time of hospitalization (14.2 days) compared to an average time of 12.8

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Male (n)</th>
<th>Female (n)</th>
<th>Percentage of male on male total</th>
<th>Percentage of female on female total</th>
<th>Average age (years)</th>
<th>Average length of stay (days)</th>
<th>Average male age (years)</th>
<th>Average male length of stay (days)</th>
<th>Average female age (years)</th>
<th>Average female length of stay (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santo Stefano (Prato)</td>
<td>124</td>
<td>100</td>
<td>55%</td>
<td>45%</td>
<td>71.3</td>
<td>13.0</td>
<td>68.0</td>
<td>13.2</td>
<td>75.3</td>
<td>12.8</td>
</tr>
<tr>
<td>San Jacopo (Pistoia)</td>
<td>154</td>
<td>139</td>
<td>53%</td>
<td>47%</td>
<td>71.5</td>
<td>12.9</td>
<td>68.8</td>
<td>12.8</td>
<td>74.6</td>
<td>13.0</td>
</tr>
<tr>
<td>Mugello (Florence)</td>
<td>16</td>
<td>24</td>
<td>40%</td>
<td>60%</td>
<td>72.0</td>
<td>11.5</td>
<td>7.8</td>
<td>12.9</td>
<td>70.9</td>
<td>10.5</td>
</tr>
<tr>
<td>Santa Maria Nuova (Florence)</td>
<td>55</td>
<td>49</td>
<td>53%</td>
<td>47%</td>
<td>71.1</td>
<td>9.8</td>
<td>69.7</td>
<td>9.8</td>
<td>72.7</td>
<td>9.9</td>
</tr>
<tr>
<td>Santa Maria Annunziata (Florence)</td>
<td>137</td>
<td>119</td>
<td>54%</td>
<td>46%</td>
<td>72.4</td>
<td>12.5</td>
<td>68.7</td>
<td>12.3</td>
<td>76.7</td>
<td>12.7</td>
</tr>
<tr>
<td>San Giovanni di Dio (Florence)</td>
<td>93</td>
<td>88</td>
<td>51%</td>
<td>49%</td>
<td>75.4</td>
<td>14.2</td>
<td>72.4</td>
<td>13.8</td>
<td>78.6</td>
<td>14.6</td>
</tr>
<tr>
<td>San Giuseppe (Empoli)</td>
<td>73</td>
<td>49</td>
<td>60%</td>
<td>40%</td>
<td>68.6</td>
<td>13.3</td>
<td>66.9</td>
<td>13.9</td>
<td>71.1</td>
<td>12.4</td>
</tr>
<tr>
<td>Total</td>
<td>652</td>
<td>568</td>
<td>53%</td>
<td>47%</td>
<td>71.9</td>
<td>12.8</td>
<td>69.1</td>
<td>12.8</td>
<td>75.1</td>
<td>12.7</td>
</tr>
</tbody>
</table>

DISCUSSION

Since a novel coronavirus was first identified in Wuhan, Hubei province in China in December 2019, the number of cases increased abruptly, with the infection spreading rapidly to other Chinese cities and too many other countries around the world [7]. In the present study data, concerning hospitalization, discharge, mortality, length of stay, distribution about age and gender, were recorded in the period between February 24, 2020 and May 18, 2020, in 7 hospitals managed by CT-HLA and dedicated to receive and treat patients with SARS-Cov2 infection. The total amount of hospitalizations in Table 1: Total hospitalizations, percentage on the total hospitalizations, catching area, percentage on catching area.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Hospitalizations (n)</th>
<th>% hospitalizations on total</th>
<th>Catching area (n)</th>
<th>% catching area on total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santo Stefano (Prato)</td>
<td>224</td>
<td>18%</td>
<td>257716</td>
<td>16%</td>
</tr>
<tr>
<td>San Jacopo (Pistoia)</td>
<td>293</td>
<td>24%</td>
<td>292473</td>
<td>18%</td>
</tr>
<tr>
<td>Mugello (Florence)</td>
<td>40</td>
<td>3%</td>
<td>63847</td>
<td>4%</td>
</tr>
<tr>
<td>Santa Maria Nuova (Florence)</td>
<td>104</td>
<td>9%</td>
<td>378839</td>
<td>23%</td>
</tr>
<tr>
<td>Santa Maria Annunziata (Florence)</td>
<td>256</td>
<td>21%</td>
<td>184599</td>
<td>11%</td>
</tr>
<tr>
<td>San Giovanni di Dio (Florence)</td>
<td>181</td>
<td>15%</td>
<td>209302</td>
<td>13%</td>
</tr>
<tr>
<td>San Giuseppe (Empoli)</td>
<td>122</td>
<td>10%</td>
<td>241884</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>1220</td>
<td>100%</td>
<td>1628660</td>
<td>100%</td>
</tr>
</tbody>
</table>
in CT-LHA and an average discharges’ hospitalization time clearly higher than in the other hospital (16.1 vs 13.6) were recorded in San Giovanni di Dio hospital.

The study shows a lower mortality than literature [7,8]. This is probably the result of the CT-LHA choice to give great importance to creation in all 7 hospitals of high care beds outside ICU setting, characterized by multi-professional and multidisciplinary assistance. This strategy allowed not only to minimize hospitalizations in ICU beds, but also to provide a better health care to patients recovered in ICUs that were able to hospitalize only those patients who needed intubation without a full occupancy of ICU-beds.

Also, the average length of stay is quite low. This is the result of the implementation of discharge procedures towards territorial structures, in particular towards low care hospital with H24 medical and nursing care, created ad hoc for the management of Covid-19 cases in post-discharge.

The strength of this study is represented by the manual review of the data by Health Directors of each of the seven hospitals involved on electronic health record database.

On the contrary a main limitation is represented by coexistence of Covid-19 codification as secondary diagnosis in hospital admissions for other reasons so the total amount of patients hospitalized just for Covid-19 disease could be slightly overrated. We are planning to run a specific study on this aspect.

CONCLUSION

Covid-19 disease has created significant management difficulties at the beginning as pathogenesis, clinic manifestations and evolution
were unknown. Therefore, first experiences and parameters control, compared with international literature and homologous working group’s experiences led to significantly better approaches and treatments resulting in higher medical performances.

Covid-19 disease has mainly affected subjects frail by age and consequently for comorbidity whose influence we reserve the right to evaluate in a further study.

ACKNOWLEDGEMENTS

We would like to thank all the Health Directors of hospitals involved on the manual review of the electronic health record database of patients.

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