

Case Report

SARS-CoV-2 Delta and Omicron Variants: Comparative Analysis of Confirmed Cases in Multi-Profile Hospital in Bulgaria

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Abstract

The highly transmissible variants of SARS-CoV-2, Delta (B.1.617.2) and Omicron (B.1.1.529), emerged as „variants of concern“ (VOCs) during the COVID-19 pandemic. The aim of this study was to perform a comparative analysis of the confirmed SARS-CoV-2 Delta and Omicron cases among the patients of Uni Hospital (Panagyurishte, Bulgaria). A total of 240 samples out of 2,373 PCR-positive samples collected from COVID-19 patients for the period from 1st July 2021 to 4th February 2022 were analyzed at NCIPD by whole genome sequencing to determine the viral variant. The Delta variant was confirmed for 103 patients, while Omicron for 137 patients. The analysis showed that 6/103 of the Delta variant cases belonged to hospitalized and unvaccinated patients with comorbidities, at a mean age of 68.8 years, two of whom had a lethal outcome. The Omicron cases were mainly in ambulatory patients (136/137), with only one hospitalized. The largest number of Omicron infected patients were in the age group of under 20 years; respectively, this age range had the lowest number of Delta variant cases. The Delta variant was the dominating SARS-CoV-2 variant in the period July 2021 - December 2021; however, it was subsequently displaced by Omicron domination. COVID-19 associated mortality remains one of the most important clinical outcomes.

Keywords: COVID-19, SARS-CoV-2, Delta (B.1.617.2), Omicron (B.1.1.529), PCR

Резюме

По време на пандемията от COVID-19 високопреносимите варианти на SARS-CoV-2, Делта (B.1.617.2) и Омикрон (B.1.1.529) бяха определени като „варианти на безпокойство“ (VOCs). Целта на това проучване е да се направи сравнителен анализ на потвърдените случаи на Делта и Омикрон варианти на SARS-CoV-2 сред пациентите на Уни Хоспитал, Панагюрище. Общо 240 проби от 2 373 PCR позитивни проби, събрани от пациенти с COVID-19 за периода от 1 юли 2021 година до 4 февруари 2022 година, бяха анализирани в НЦЗПБ чрез целогеномно секвениране за определяне на вирусния вариант. Делта вариант на SARS-CoV-2 е доказан при 103 пациенти, докато Омикрон при 137 пациенти. Анализът показва, че 6/103 от случаите на Делта вариант са на хоспитализирани и неваксинирани пациенти с придружаващи заболявания, на средна възраст 68.8 години, двама от които са починали. Случаите на Омикрон са предимно при амбулаторни пациенти (136/137), като само един е хоспитализиран. Най-много заразени с Омикрон са във възрастовата група под 20 години; съответно при Делта варианта в този възрастов диапазон има отчетени най - малък брой случаи. Делта е доминиращият вариант на SARS-CoV-2 в периода юли 2021 - декември 2021 г., след което беше заменен от Омикрон. Асоциираната с COVID-19 смъртност остава един от най-важните клинични резултати.

Introduction

The first cases of atypical pneumonia of unknown cause were reported in China at the end of 2019. Soon after, the etiological agent was identi-

fied, a new coronavirus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and the infectious disease that it causes was named

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Coronavirus Disease (COVID-19). During the COVID-19 pandemic, multiple variants of SARS-CoV-2 emerged with different transmissibility and severity. The Delta (B.1.617.2) and Omicron (B.1.1.529) variants quickly spread globally, and were designated by the World Health Organization (WHO) as “variants of concern” (VOCs). Delta was initially detected in India in late 2020, and the first cases of Omicron were reported in November 2021 in Africa (South Africa and Botswana). The term “VOCs” refers to viral variants with mutations in the receptor-binding domain (RBD) of the spike protein (S) that dramatically improve its binding affinity to angiotensin-converting enzyme 2 (ACE2). The Omicron variant contains an unusually high number of mutations, twice as many as the Delta variant (Wolter *et al.*, 2022). They entail its increased transmissibility and the possibility of “immune escape” (Mohapatra *et al.*, 2022); and the reduced activity of neutralizing antibodies increases the risk of recurrent infections (Dyer, 2021). In Europe, the number of confirmed cases reported between December 2021 and March 2022 (Omicron period), exceeded all previously reported cases. Breakthrough infections are less common in fully vaccinated people. The patients with a fully completed vaccination course had better in-hospital outcomes than unvaccinated patients (Myers LC *et al.*, 2022).

COVID-19 has a variable clinical presentation and progression. SARS-CoV-2 affects not only the respiratory system but also multiple organs. Omicron replicates better in the cells of the upper respiratory tract (URT) than in the lungs (Hui *et al.*, 2022). Studies have shown that Omicron variant infection is less likely to involve the lower respiratory tract (LRT) and cause pneumonia and potentially fatal acute respiratory distress syndrome (ARDS). The most common symptom of severe disease is dyspnea, which is a result of hypoxemia (Zhou *et al.*, 2020). Observations show that the risk of intensive care unit admission and death is greater in cases of the Delta variant, whereas in Omicron the course is more often asymptomatic or mild, with low rates of hospitalization and mortality. Unfavorable prognostic factors are advanced age, concomitant diseases, negative vaccination status, development of some complications, as well as deviations of some laboratory parameters from the reference range.

The reliability of COVID-19 test results is of essential importance for confirmed diagnosis. The gold standard for SARS-CoV-2 detection in

laboratory practice is RT-PCR (Real-time reverse transcription polymerase chain reaction) (Loeffelholz and Tang, 2020). Proper specimen collection is an important pre-analytical step. The most commonly preferred specimens from the URT are nasopharyngeal and/or oropharyngeal swabs and from the LRT are bronchoalveolar lavage (BAL), tracheal aspirate, and sputum.

The aim of this study was to perform a comparative analysis of the confirmed cases of SARS-CoV-2 Delta (B.1.617.2) and Omicron (B.1.1.529) variants in the hospital in Panagyurishte from 1st July 2021 to 4th February 2022.

Materials and Methods

A total of 8,871 nasopharyngeal swabs or oropharyngeal swabs (specimens) of hospitalized and ambulatory patients of Uni Hospital were examined by RT-PCR for detection of SARS-CoV-2 in the period of July 1, 2021 - February 4, 2022. Automated extraction of viral RNA was performed with a Nucleic Acid DNA/RNA Extraction kit (Wuxi NESAT Biotechnology Co., Ltd). A commercial Real-time PCR Kit LiliFTM COVID-19 (iNtRON, South Korea) was used for the simultaneous detection of three SARS-CoV-2 gene targets (E-, N- and RdRp-genes), two of them specific (N and RdRp) and one common (E) for all coronaviruses. At NCIPD, 240 SARS-CoV-2 positive samples underwent whole genome sequencing (WGS) to identify the viral variant (Delta/Omicron). The patients (121 men and 119 women) with Delta and Omicron variants of SARS-CoV-2 were grouped by age, vaccination, and premorbid status, as well as the number of deaths. Total hospital days were defined as days from admission to date of death. Clinical and laboratory data of patients were collected from electronic medical records.

Results

Of a total of 8,871 patients tested for SARS-CoV-2 for the observation period in this study, 2373 (27%) had a laboratory-confirmed diagnosis of COVID-19 (positive PCR test result) and respectively 6498 (73%) were negative. At the beginning of February (1st – 4th Feb 2022), of 327 examined respiratory samples, almost half were positive for SARS-CoV-2 (150/327). The data from the sequencing analysis of 240 samples of outpatients and hospitalized patients of Uni Hospital showed that the Delta variant was present in 43% (n=103; 38 men and 65 women) of the cases and Omicron in 57% (n=137; 83 men and 54 women) of the cases (Fig. 1).

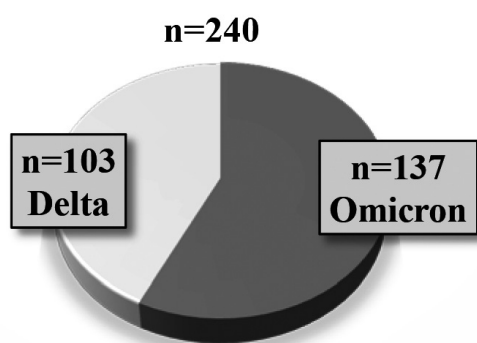


Fig. 1. Distribution of confirmed cases of Delta and Omicron SARS-CoV-2 variants at Uni Hospital (Panagyurishte) from 1st July 2021 – 4th February 2022.

Of a total of 103 confirmed cases of the Delta variant, 93 of the specimens were taken during the period of increased spread of this variant (1st Jun 2021 – 31st Dec 2021). All 137 Omicron cases were from specimens taken during the period of high prevalence and dominance of this highly infectious variant of SARS-CoV-2 (29th Dec 2021 – 4th Feb 2022). The first confirmed case of Omicron at Uni Hospital was a 32-year-old man from Panagyurishte who had not had COVID-19 previously and was not vaccinated; his specimen was taken on 29th Dec 2021. The analysis showed that 6/103 cases of the Delta variant were in hospitalized patients who were polymorbid and unvaccinated, and two of them died. The average age of these 6 patients was 68.8 years, and in all of them, X-ray or computed tomography examination revealed interstitial inflammatory changes in the lungs. Their average hospital stay was 8 days. Among the cases with confirmed Omicron variant, the predominant part were outpatients, with only one hospitalized patient with comorbidities and no deaths recorded. The age distribution of the patients with the SARS-CoV-2 Delta and Omicron variants shows that the largest number of Omicron cases were under 20 years of age (n=31), while the number of Delta variant cases in this age group was the lowest (n=9) (Table 1). The oldest patient was a 90-year-old woman (with the Delta variant), whereas the youngest patient was a 2-year-old male child (with the Omicron variant).

The analysis of the vaccination status showed that 14% (18/103) of the patients with the Delta variant were vaccinated, with four having an incomplete course of vaccination (with only the first dose of the mRNA vaccine administered). In the risk group > 60 years, 6 patients had received two doses of vaccine and 21 were unvaccinated. Of a total of 137 Omicron cases, 20 had completed a two-dose vaccine course and 117 were unvaccinat-

ed. Twenty-five of the Omicron patients reported recurrence of COVID-19 (history of illness in 2020 or 2021), and only three of them had been vaccinated. Omicron can cause reinfection, even in people who have recovered from COVID-19. Omicron infection resulted in high transmission among household contacts.

Table 1. Age distribution of patients with SARS-CoV-2 Delta and Omicron variants

| Age groups (years) | n (Delta) | n (Omicron) |
|--------------------|------------|-------------|
| <20 | 9 | 31 |
| 21-30 | 13 | 13 |
| 31-40 | 14 | 29 |
| 41-50 | 18 | 20 |
| 51-60 | 22 | 26 |
| >60 | 27 | 18 |
| Total | 103 | 137 |

Discussion

All SARS-CoV-2 variants can cause serious illness or death. From July 2021 to December 2021, Delta was the dominant variant, after which it was displaced by Omicron. Observations have shown that the rates of hospitalization and mortality were high during the Delta wave. Omicron was associated with a lower severity of infection, reinfections in previously recovered COVID-19 patients, and sudden (breakthrough) infections in vaccinated individuals (Mahase, 2021).

The comparative analysis showed that the cases of registered SARS-CoV-2 Delta variant were most prevalent among the patients over 60 years, and respectively, least prevalent in the age group < 20 years. All hospitalized patients with a fatal outcome in Uni Hospital, who had a confirmed Delta variant were unvaccinated, advanced age, and with concomitant chronic diseases. In Omicron cases, the course was milder, ambulatory patients predominated, and children and people of working age were mostly affected. Among the patients with the proven Omicron variant, there were no reported deaths, and there was only one hospitalization of a 63-year-old patient with an oncological disease and two doses of the vaccine.

There are multiple factors that lead to an unfavorable COVID-19 outcome. Studies indicate that most symptomatic and hospitalized cases are in comorbid and elderly COVID-19 patients (Du *et al.*, 2020). Vaccine hesitancy, defined as delayed intake or refusal of immunization, appears to be a negative prognostic factor. In addition, as age advances it is

more difficult to build strained immunity as a result of the so-called “immune aging” which is why the effectiveness of the vaccines is lower. The benefit of booster vaccination has been proven as the most effective preventive measure.

Conclusion

Delta and Omicron variants emerged as the VOCs. An outstanding feature of the Delta variant is its high viral load and high virulence. The Omicron variant of SARS-CoV-2 has demonstrated partial vaccine escape, high transmissibility, and significantly lower risk of hospitalization and mortality compared with the Delta variant. The comparative analysis showed a milder course in the Omicron variant among the patients of Uni Hospital, with children and people of working age being affected predominantly, while with the Delta, the number of infected patients above 60 years with comorbidities prevailed and there were cases of death. The observations showed, that fully vaccinated individuals were less likely to develop severe illness and death. To reduce COVID-19-related hospital admissions, it is essential that the vaccine coverage in the population is sufficiently high.

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