

**VARIANTE
ÔMICRON**

Omicron SARS-CoV-2 variant

Elaheh seidaie MD

Assicant professor of SH.K university of medicine

- On Nov, 2021, about 23 months since the first reported case of COVID-19 a new SARS-CoV-2 variant of concern (VoC), omicron was reported.
- Omicron emerged in a COVID-19-weary world in which anger and frustration with the pandemic are rife amid widespread negative impacts on social, mental, and economic wellbeing.

- Although previous VoCs emerged in a world in which natural immunity from COVID-19 infections was common, this fifth VoC has emerged at a time when **vaccine immunity is increasing** in the world.

- The first sequenced omicron case was reported from Botswana on Nov, 2021, and a few days later another sequenced case was reported from Hong Kong in a traveller from South Africa.



- In South Africa, the mean number of 280 COVID-19 cases per day in the week before the detection of omicron **increased to 800 cases per day** in the following week, partly attributed to increased surveillance.



- Clinicians in South Africa suggest that patients with omicron are **younger people** with a clinical presentation similar to that of past variants.

- Using computer models of the spike protein on Omicron's surface, they analyzed molecular interactions occurring when the **spike grabs onto a cell-surface protein** called ACE2, the virus's gateway into the cell.

- Metaphorically, the original virus had a handshake with ACE2, but **Omicron's grip** "looks more like a couple holding hands with their fingers entwined.

- The "molecular anatomy" of the grip may assist in explaining how Omicron's mutations cooperate to help it infect cells.

- The Omicron SARS-CoV-2 variant shows **more than 30 mutations** leading to amino-acid changes in the Spike sequence, 15 of them located in the Receptor-Binding Domain.
- These mutations, which may **enhance viral infectivity**.

- Studies showed that a combination of mutations in the RBD would yield **a high binding affinity with human ACE2** of this variant.

- To replace the Delta variant as the main circulating variant, **a huge increase in infectivity and/or transmissibility** of Omicron variant would be needed.

- PCR tests (NAAT tests) performance are not impacted by this new variant except for a specific S-gene target failure (SGTF) due to the deletion in position 69–70 of the spike sequence as previously observed with the Alpha variant.



- This importance of using tests targeting at least two different genomic regions of the SARS-CoV-2 sequence in order to prevent false negativity of tests due to major changes in one of the targets.

Immune escape

- The high frequency of mutations in the spike sequence of the Omicron variant raises concern about a potential **immune escape** of this variant.

- In vitro serum neutralisation assays with sera from patients previously infected by different variants of SARS-CoV-2 and from people vaccinated with the distinct vaccines, including heterologous vaccination, must be carried out against the Omicron variant.

- This result suggests that the Omicron variant has **an ability to evade immunity from prior infection** The results are not applicable to vaccination as vaccination coverage in South Africa was very low during the study.

- Pharmaceutical labs are already assessing the efficacy of their vaccines against this new variant (Moderna, Pfizer and AstraZeneca) and some of them mentioned that they could adapt their vaccine design if needed.

- **Cellular immunity** is directed against different viral spike epitopes, we can assume that it may not be as impacted as humoral immunity by the virus evolutions.
- We already know that COVID-19 vaccines reduce infection frequency and have a great efficacy to prevent severe COVID-19 disease.

Severity of Omicron

- Some say, before any published data, that the new variant will lead to less severe cases while others say that it will lead to more severe cases, especially in children.
- There are too **many confounding factors** to compare patients with the Omicron variant in South Africa with patients infected by other variants.

□ **Severity and mortality** depending :

Country, the prevalence of vaccination, the population's characteristics including age, socio-economic level or comorbidities, medical management

- we have few data on the Omicron variant and studies must be quickly carried out to better define the threat that this variant represents.

- **Protective measures** and **vaccination** will still be the key elements to counter the spread of the new variant and to prevent new waves of severe COVID-19 cases and deaths.



DIAGNOSIS



RT-PCR :



- The gold standard for diagnosis
- Its sensitivity is not satisfactory
- Mutations in the virus genome producing false negative results.

- The SARS-CoV-2 virus has mutated over time. **Molecular, antigen, and serology tests are affected by viral mutations** differently due to the inherent design differences of each test.
- A mutation of SARS-CoV-2 virus is a change in the genetic sequence of the SARS-CoV-2 virus when compared with a Wuhan-Hu1 variant.

- Consider repeat testing with a **different molecular diagnostic test** (with different genetic targets) if COVID-19 is still suspected after receiving a negative test result.

- Multiple targets means that a molecular test is designed to detect **more than one section of the SARS-CoV-2 genome** or, for antigen tests, **more than one section of the proteins** that make up SARS-CoV-2.

- **The omicron variant** has significantly more mutations than previous SARS-CoV-2 variants, particularly in its S-gene, the gene that encodes the virus's spike protein.



- The FDA is working with our government partners and test developers to evaluate the impact of the omicron variant on SARS-CoV-2 diagnostic tests.
- These tests are expected to detect the SARS-CoV-2 omicron variant. Due to mutations found in the SARS-CoV-2 omicron variant.

- In tests that are designed to detect multiple genetic targets. The detection pattern, showing the drop out, or failure of the affected target, may help to signal the presence of the omicron variant in a patient sample sequencing can be considered to characterize the variant.

- Testing positive for SARS-CoV-2 with one of these tests does not mean an individual is infected with the omicron variant.
- **Not all patient** samples with the omicron variant display a mutation that leads to a gene drop out.

- The omicron variant may still be present without a gene drop out detection pattern.



Rapid antigen test:

- Most are rapid tests based on the detection of the nucleocapsid (N) antigen to prevent invalidation from spike protein variations.

- Some mutations are detected on the Omicron nucleocapsid sequence.
- These mutations could impact the ability of rapid tests to detect the Omicron variant is still not known but some firms already communicated by press release that their antigen tests were not impacted.

- Antigen tests are known to be **less sensitive** than RT-PCR tests.
- It is then recommended to prefer RT-PCR tests when a potential Omicron infection is suspected.

Serological tests:

- Serological tests should be indicated from the second week of symptoms onwards.
- Antibodies against S protein, where the receptor-binding domain (RBD) is located, are very specific.

- The assessment of specific antibodies to N protein is more sensitive and less specific, since this.
- Antibodies directed to S protein are more specific to SARS-CoV-2, because in this protein is RDB.

- When RT-PCR is not available or is negative in the face of a suggestive clinical picture, when the patient has been **symptomatic for over 14 days**, or to assist in the diagnosis of COVID-19-related **multisystemic inflammatory syndrome**.

Positive result :

- It is possible that you have recently or previously had COVID-19.



False positive :

- Detect **coronaviruses other** than SARS-CoV-2
- Population without many cases** of COVID-19 infections.
- These types of tests work best in populations with higher rates of infection.

Negative result :

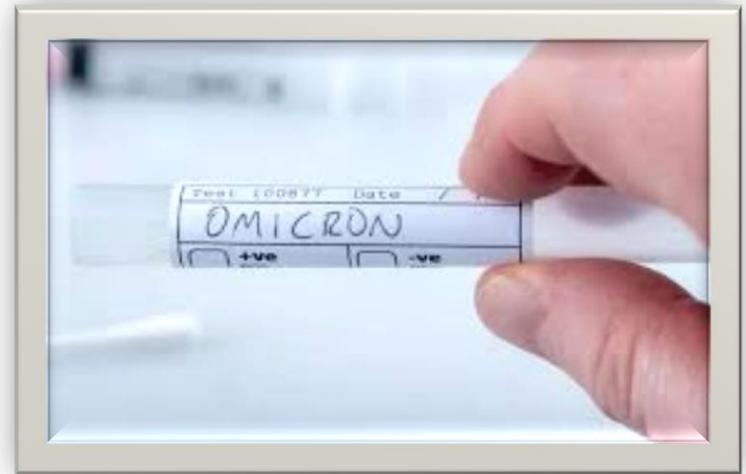
- You have not been infected with COVID-19 previously



False negative:

- The test **does not detect antibodies** even though you may have specific antibodies for SARS-CoV-2.
- You are tested **soon** after being infected.

- Absence of antibodies **does not imply** the absence of contact or protection against the virus, since there may be an efficient **specific cellular immune response.**



- Presence of antibodies **does not rule out** the possibility that the individual is still infectious.
- Antibody tests **are not recommended** to determine your level of immunity or protection from COVID-19.

Laboratory tests :

CBC, CRP, D- dimer , LDH, Ferritin ,
Procalcitonin , PT, PTT, INR, CPK, SGPT, SGOP ,
Troponin , BUN, and Creatinine

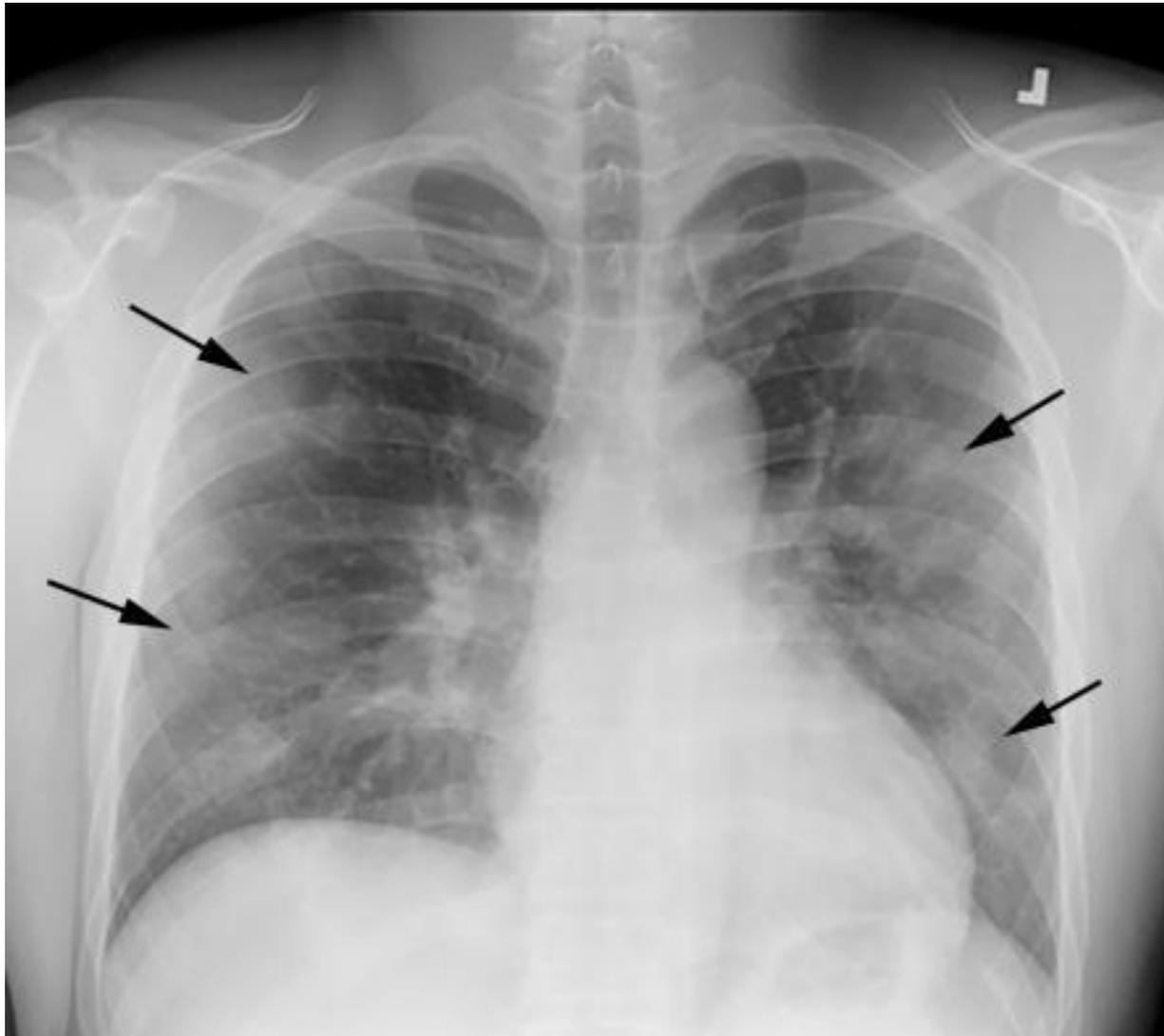
Immunological markers :

1. decreased CD4 + T and CD8+ lymphocytes, and NK cells
2. increased IL6 , IFN- γ , TNF- α

Imaging tests

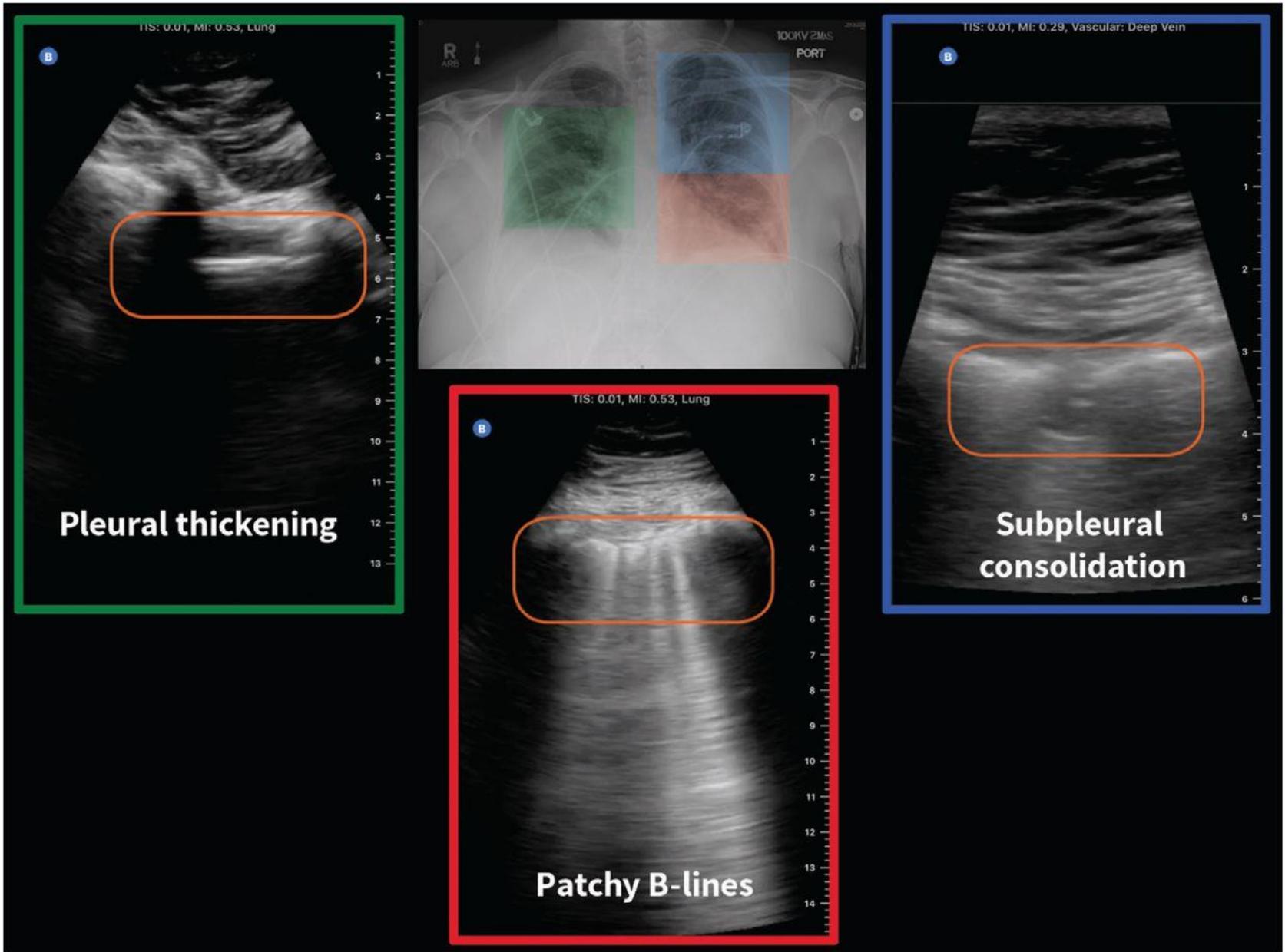
chest X-rays :

- less sensitive than CTS
- Bilateral ground glass opacities in peripheral/subpleural, predominantly in the lower lobes



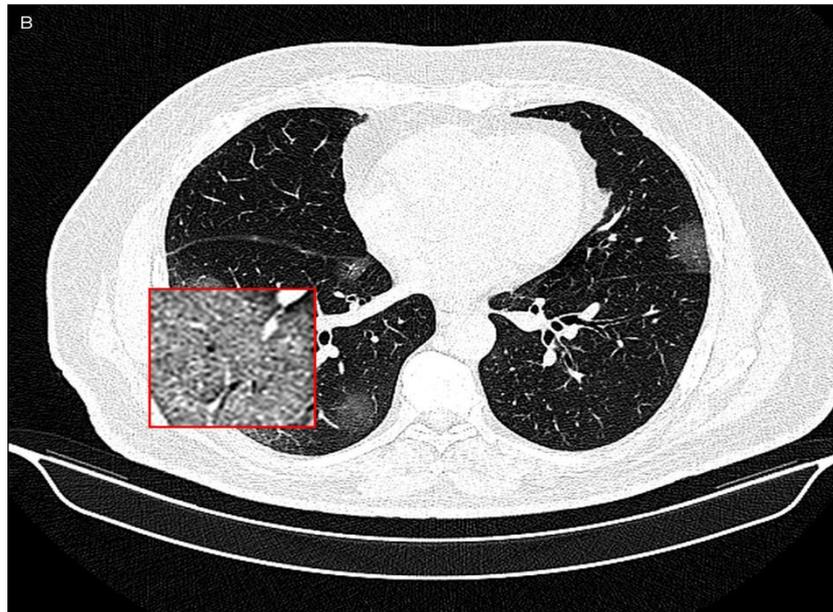
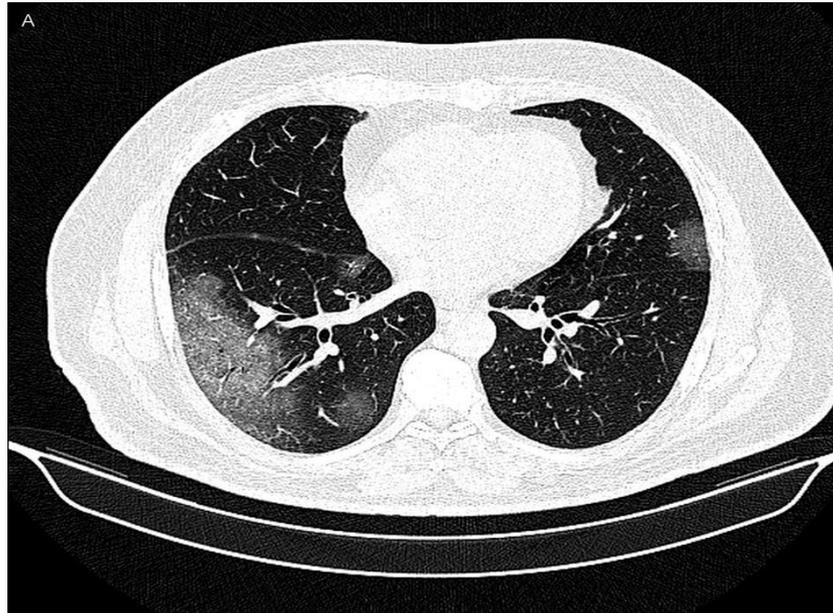
Pulmonary ultrasonography :

- Good sensitivity
- B-lines
- Consolidations
- Pleural thickening



CT SCAN of the chest:

- Greater sensitivity
- Multifocal, bilateral, peripheral/subpleural ground glass opacities of the lower lobes
- Inverted halo sign
- Crazy paving



- Diagnosis of COVID-19 :

- Clinical and epidemiological history
- Tests for etiological diagnosis
- Tests to support the diagnosis of infection and/or its complications

Thank you for your attention

