



Investigation of Inflammatory Serum Parameters in Long-Covid Patients with Neurological Complaints

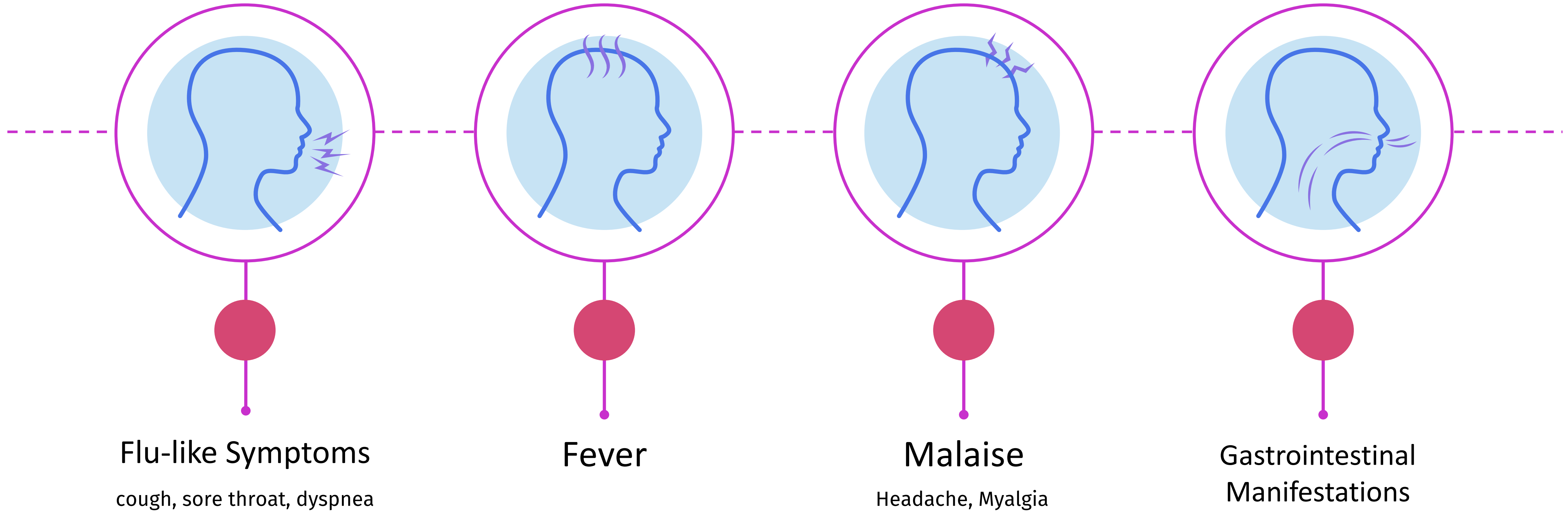
Kerim Ferhatođlu ¹
Assoc. Prof. Dr. Ferda Uslu ²

¹ Bezmialem Vakıf University, Faculty of Medicine, İstanbul, Turkey

² Bezmialem Vakıf University, Faculty of Medicine, Department of Neurology, İstanbul, Turkey

Acute COVID-19

Symptoms



Long Covid Syndrome

Definition



Multisystem involvement

3 – 6 months after the acute infection

Time and severity of the acute infection

Hospitalization, need of ICU and vaccination history

Diagnosing the Acute Covid-19



1

RT-PCR

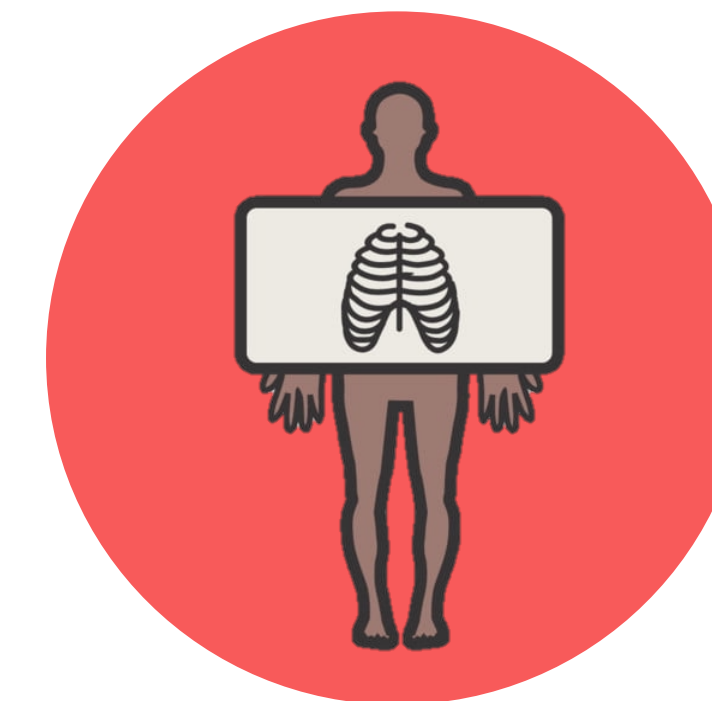
RT-PCR analysis of the swabs taken from Upper Respiratory Tract



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Blood Test

TBC, CBC, CRP, Ferritin, D-dimer, LDH...



3

Chest Imaging

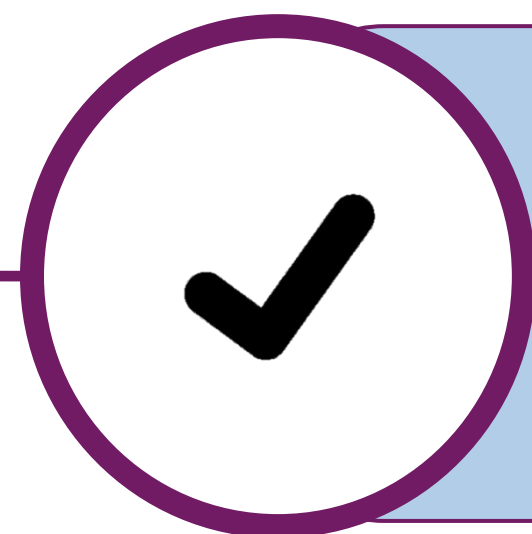
X-ray or CT scan of the lungs

Diagnosing the Long-Covid



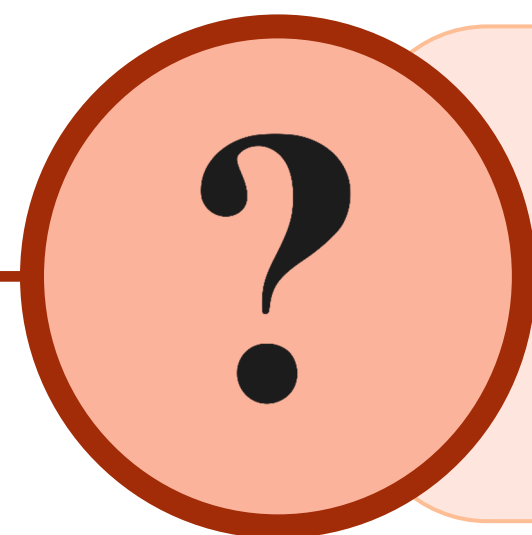
Previous Covid-19 infection

Being diagnosed with Covid before Long-Covid symptoms



New symptoms

Experiencing previously non-existent findings



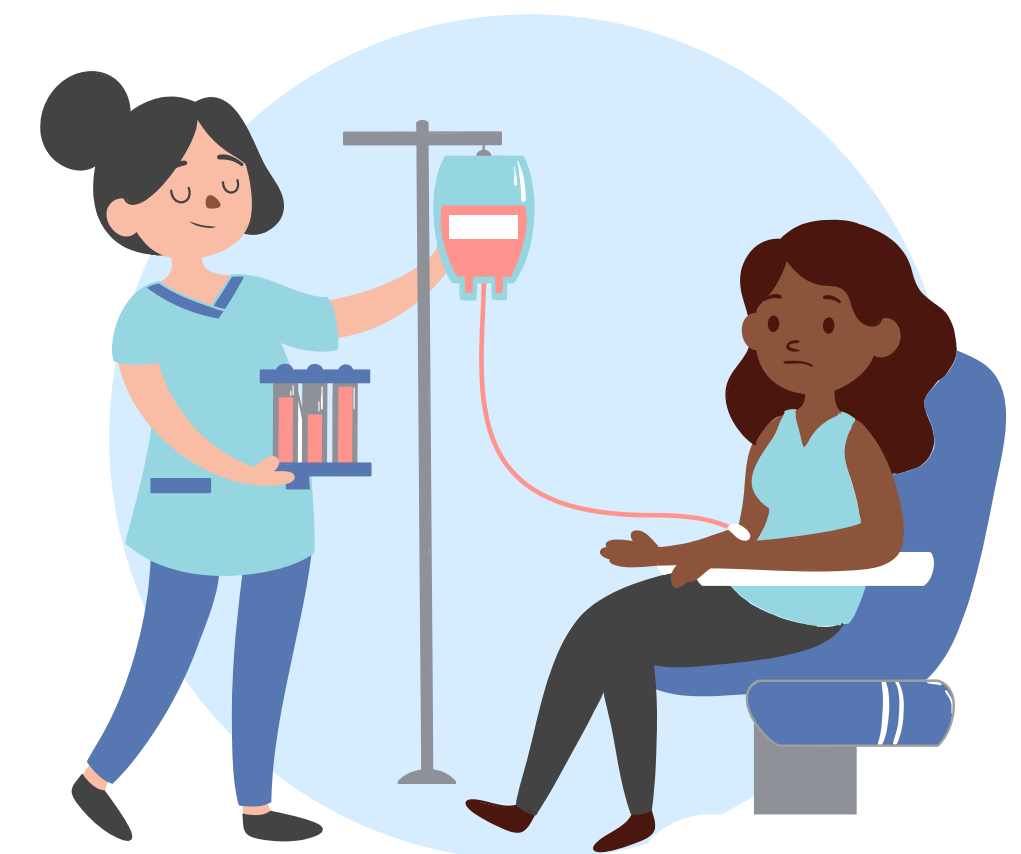
Parameters to investigate

It is not clear to investigate which parameters for Long-Covid patients.

Aim of the Research

- Multiple hypotheses have been proposed for long COVID's pathogenesis, some include persistent reservoirs of SARS-CoV-2 in tissues, immune dysregulation, autoimmunity and molecular mimicry priming of the immune system, microvascular blood coagulation with endothelial dysfunction, and dysfunctional signaling in the brainstem and/or vagus nerve.
- Multiple studies have found that cytokines like IL-6, interferons, and tumor necrosis factor increases in long COVID patients.
- Infection and Inflammation parameters such as total blood count (CBC) and CRP are frequently used during routine blood examinations.
- The change of these routine parameters, especially in this specific Long-COVID patients are **limited** and **not followed up**.

Our aim was to analyze the changes in these parameters, which are frequently used in routine examinations in Long-Covid patients



Method of the Research

Selection of the Patients

- Patients diagnosed with Covid-19 between 1st January 2021 – 30th June 2021 with RT-PCR were determined.
- Admitted to the hospital with newly experienced Long-Covid symptoms 3 to 6 months after the acute infection were selected.
- These patients were called via telephone and their symptoms were questioned and checked with their hospital admission records.
- Patients who admitted to any hospital with another condition that could affect their blood test results between their Covid diagnose and follow-up were excluded from the research.

Method of the Research

Investigated Patients

563 Patients

Investigated retrospectively

Checked their eligibility for the research.

Suitability for the research criteras was considered.



122 Patients

Were eligible for the study.

Admissioned to the hospital with Long-Covid

First and 3-6 month control admission results were compared.



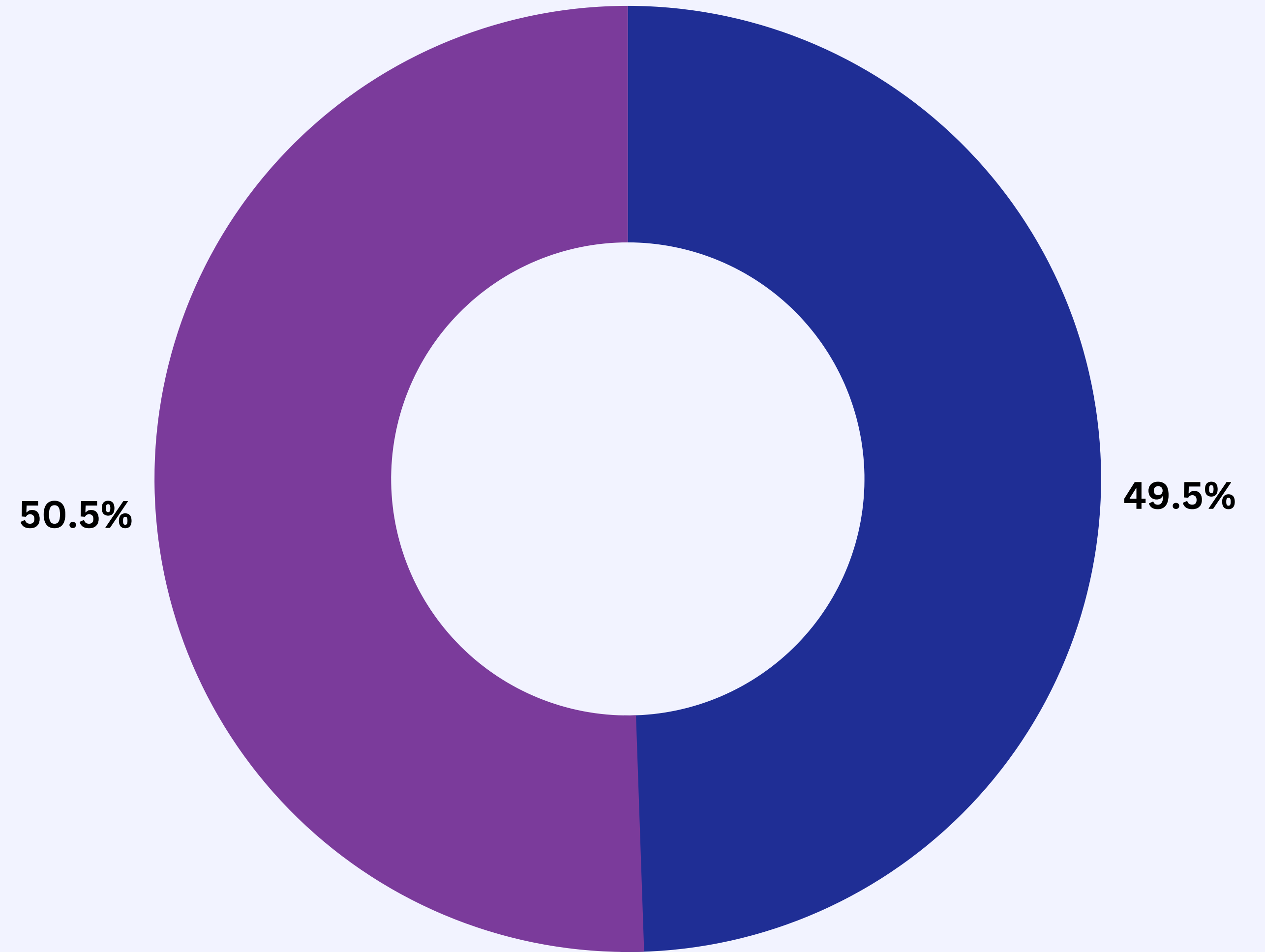
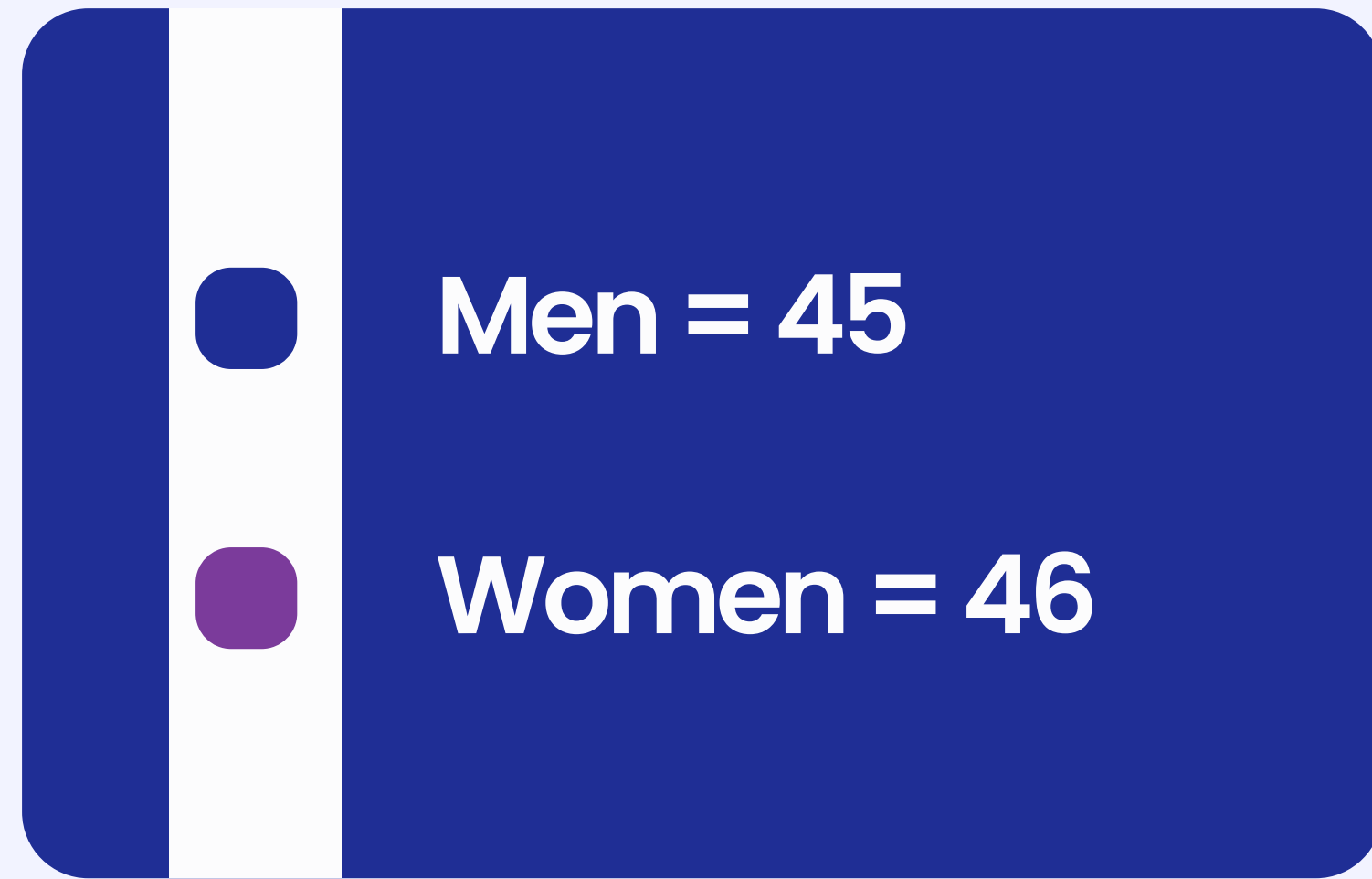
91 Patients

Data were used for the statistical analysis

All of the parameters were completely examined in these patients between the first and follow-up admission



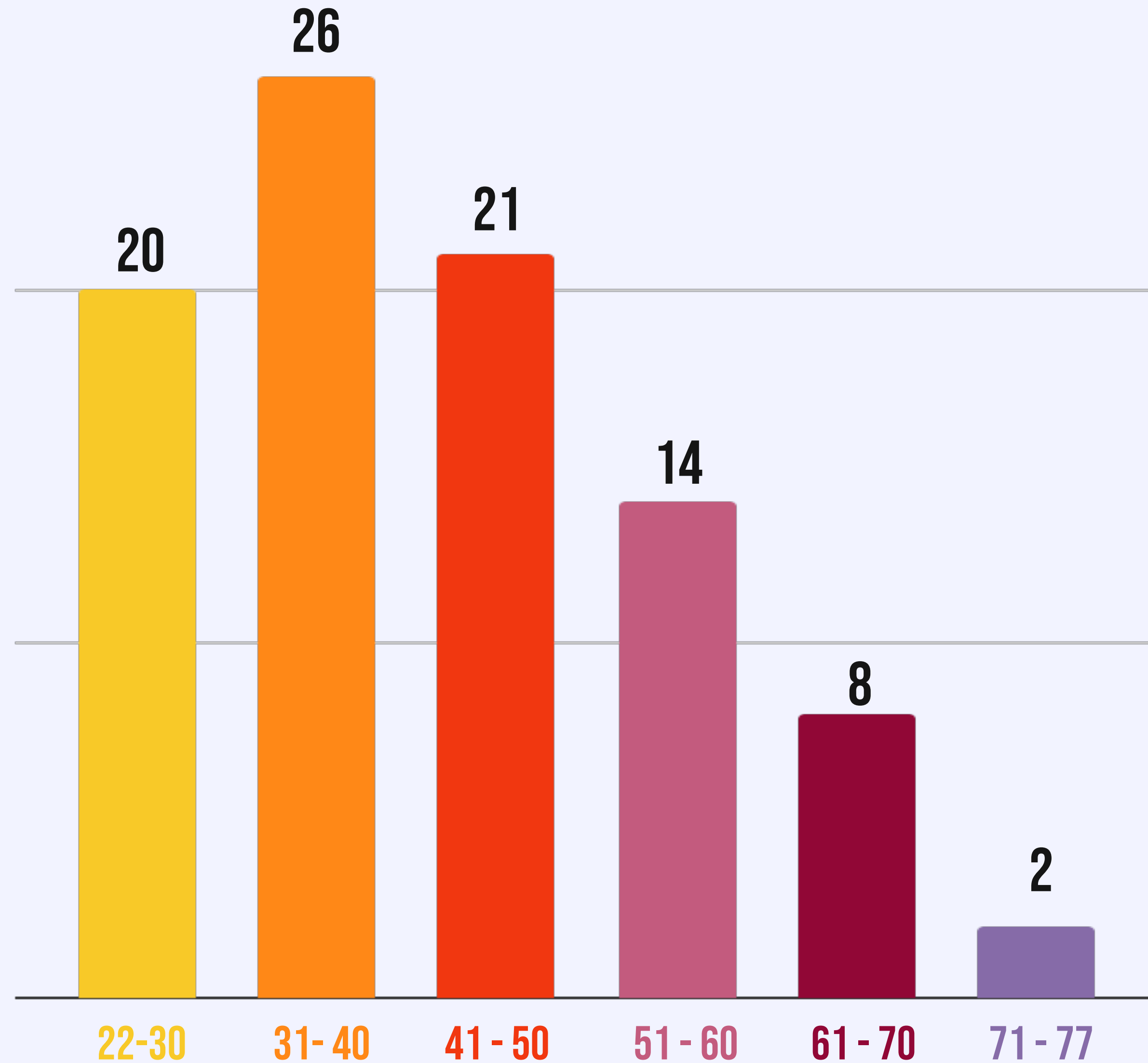
Gender



Age

- Aging from **22** to **77**
- Median age: **43**
- Average age: **44**

- **%73.6** of the patients were younger than 50 years.



Symptoms

● Post – Exertional Fatigue – **45**

● Headache - **28**

● Myalgia - **26**

● Insomnia - **9**

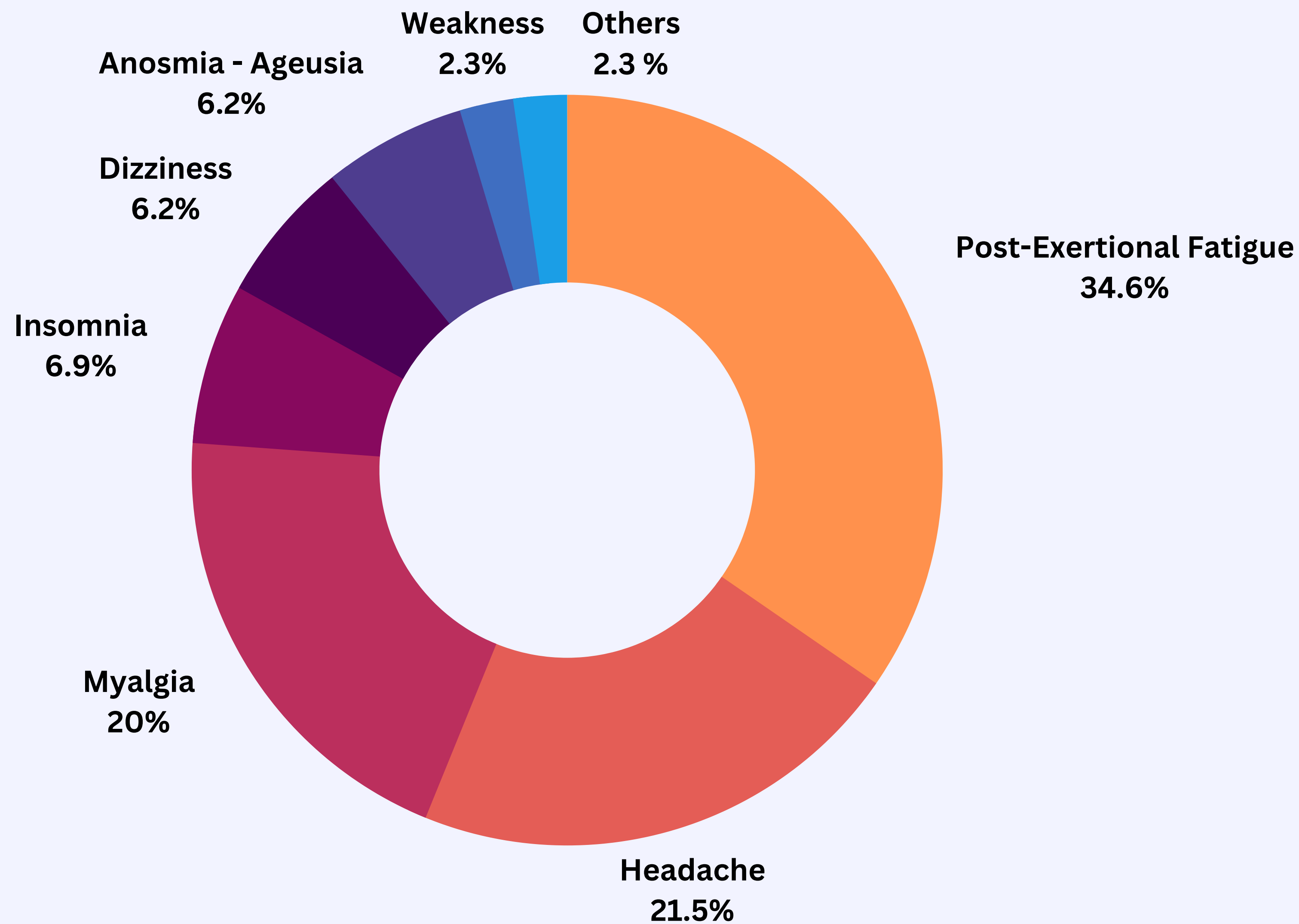
● Dizziness - **8**

● Anosmia – Ageusia - **8**

● Weakness - **3**

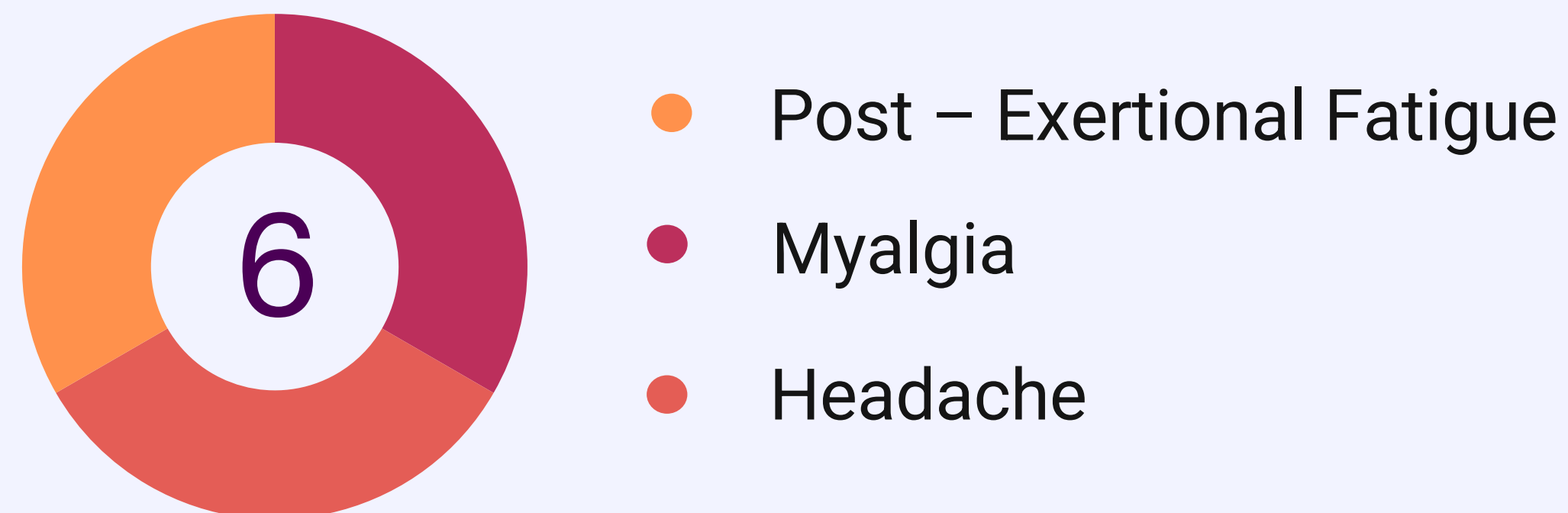
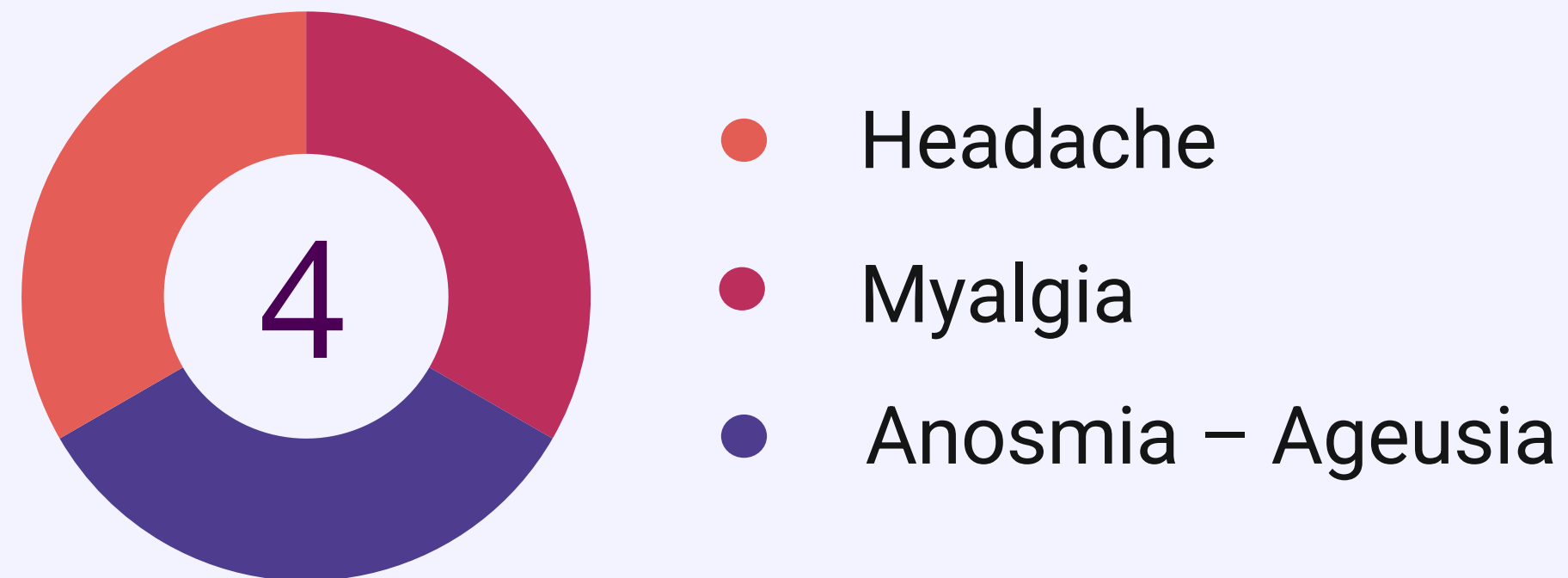
● Others: - **3**

Forgetfulness, Syncope, Epilepsy



Symptoms

- **67 %** of the patients were monosymptomatic (61 out of 91)
- **33 %** admissioned with multiple symptoms (30 out of 91)



Statistical Analysis

	First Mean	Follow-up Mean	First Standart Dev.	Follow-up Standart Dev.	P Value
Leukocyte Count (WBC)	5.80	7.07	1.75	1.94	< 0.001

	First Min-Max	Follow-up Min-Max	First Median	Follow-up Median	P Value
CRP	0.20 – 82.71	0.20 - 75.48	3.9	0.35	< 0.001
D-Dimer	83 - 2427	27 - 395	240	118	< 0.001
Ferritin	2 - 6376	1 - 4590	86.435	48.04	< 0.001
Creatinine	0,43 – 0.8	0.54 – 1.45	0.82	0.80	= 0.017
LDH	121 - 516	97 - 325	193	186	< 0.001
Neutrophile/Lymphocyte Ratio	0.4 – 10.97	0.58 - 11	2.07	1.923	= 0.004
Erythrocyte Sedimentation Rate	2 - 42	2 - 33	11	5	<0.001

	First Min-Max	Follow-up Min-Max	First Median	Follow-up Median	P Value
Serum ACE Receptor	3 - 51	4 - 36	21	20.50	= 0,113
Procalcitonin	0.01 – 2.298	0.01 – 2.00	0.177	0.120	= 0.381

Limitations and Strengths

- We wanted to see if we could find a useful marker which is monitored during the routine check of the infection for Long Covid patients. More specific inflammatory markers like TNF, IL-2 and cytokines could have been beneficial.
- The results of the research are valuable and similar with the literature, but it is recommended to investigate the parameters to be used in the diagnosis and follow-up of the Long-Covid patients in a larger group with multicentre studies.
- This research is one of the few studies conducted since the beginning of the pandemic with this hypothesis and followed the patients' symptoms and blood test results. It's also valuable to reach enough follow-up patients that can be statistically evaluated.

Discussion

Please scan the QR codes to reach
the full texts of the compared studies

Comparison with other Studies

- The frequency of admission symptoms in our study was consistent with the literature. *(Reported as (30%) fatigue, (44%) headache, (8%) myalgia in previous studies.)*¹
- Distribution of age, gender and the number of patients with multiple Long-Covid symptoms was similar with the literature. *(Mean age: 39.8, 60% were younger than 40 years, Male/Female Ratio: 1.4:1, Ratio of patients with multiple symptoms: 16% in previous studies.)*²
- Although the Neutrophile/Lymphocyte Ratio was reported as a predictive marker during the acute infection³, it isn't useful in Long-Covid patients' follow-up according to our research.



1



2



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Conclusion

- Based on the data obtained, a statistically significant decrease and normalisation to the baseline were found in **CRP, D-Dimer, Ferritin, Creatinine, LDH, NEU/LYM Ratio, Leukocyte count** and **ESR** compared to the values during the first and follow-up admissions.
- **ACE** and **Procalcitonin** remain high for a longer period of time.
- As a result, we found that there is no persistently elevated marker that is used during acute infection screening that can be used for the follow-up of the Long-Covid patients with neurological complaints.



**Thank you very much for
your interest...**

Kerim Ferhatođlu

References

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