"Unmasking the Unknown: COVID-19 Vaccination and the Hidden Risk - on arterial blood pressure and in genesis of Capillary Leak Syndrome". Cross sectional study of cases from a Covid care centre in Guwahati.

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Abstract:
Background: In the ongoing battle against the COVID-19 pandemic, vaccination has emerged as a powerful weapon to curb the spread of the virus and mitigate its severe effects. While the global vaccination efforts have undoubtedly contributed to the decline in infection rates and improved public health outcomes, an intriguing and relatively unexplored facet has surfaced - the potential impact of COVID-19 vaccination on arterial blood pressure and the manifestation of capillary leak syndrome as a complication. Globally, as per WHO dashboard data on 08th November 2023, there have been more than 77crores 18lakhs confirmed cases of Covid-19 with more than 69 lakhs78 thousand deaths worldwide as reported to WHO. As regards vaccination more than 1353million vaccine doses has been administered.[3] As regards region wise positive cases of Covid -19 Europe had maximum number of cases which was around 27 crores followed by Western pacific which had around 20crores of Covid positive cases closely followed by the Americas with more than 19 crores of the population falling victim of the pandemic. Southeast Asia had more than 6 crores of people affected. The least affected were the African continent with about 95 lakh population being affected by Covid-19.[4] As per Ministry of Health & Family Welfare government of India there are about 177 active cases of Covid -19 in India as on 09th November 2023 with over 4 crore positive cases discharged which is about 98.81% with about 5 lacs 33 thousand deaths with over 220 million vaccine doses administered.[5] In our state of Assam as on August, 2023, there are no active cases with more than 7 lakhs of cases got cured. In Guwahati city more than 5 lakh cases of Covid-19 positive cases were treated with almost 98% got cured. The introduction of vaccines was seen as a beacon of hope in controlling the spread of the virus and reducing its associated morbidity and mortality. However, there have been concerns and observations regarding the relationship between COVID-19 vaccinations and certain adverse effects, including changes in arterial blood pressure and the development of capillary leak syndrome leading to pedal edema. COVID-19 vaccines have proven to be an essential tool in curbing the spread of the virus and preventing severe illness. However, like any medical intervention, vaccines can be associated with various side effects. These effects can be influenced by various factors, including individual health conditions and vaccine types. The relationship between COVID-19 vaccination and such adverse effects is an active area of research, The COVID-19 pandemic has challenged the global healthcare community to develop effective vaccines at an unprecedented pace. The rapid deployment of vaccines, such as those developed by Pfizer-BioNTech, Moderna, AstraZeneca, and others like Covaxin, Covishield, had offered a glimmer of hope in controlling the spread of the SARS-CoV-2 virus. As millions of people worldwide

received these vaccinations, there have been numerous reports and concerns about potential side effects and adverse reactions, ranging from mild fever and fatigue to more severe outcomes. This introduction focuses on a specific aspect of these vaccine-related concerns: their potential influence on arterial blood pressure and the development of capillary leak syndrome, which may manifest as pedal edema (swelling of the feet and ankles). **Methods:** The blood pressure and other symptoms of 802 (n=802) covid positive individuals who were vaccinated with either the first or the second dose of vaccine were taken as the cases(18 years and above). The sample size was determined using the formula for the sample size calculation of proportions and prevalence which is given by the formula $n=Z^2p(1-p)/e^2$ where Z= confidence level at 95%(standard value of Z=1.96) 'p' estimated prevalence or proportions of the project area 'e' is the range of CI. After ethical clearance, blood pressure of the cases was measured digitally. It was also seen whether the cases had ankle and feet edema. Data obtained were analysed for demographic profile and statistical significance using the statistical analysis software of MS excel. **Results:** It was found out after measuring the blood pressure that it was raised in those persons who took Covishield vaccine (first or second dose). After second dose systolic blood pressure was raised appreciably. Amongst gender distribution, it was found out that females had more values of BP compared to males. Similarly, as regards swelling of feet and ankle is concerned females developed symptoms of CLS more than males. **Conclusion:** After carrying out the study it was found that Covishield had more cases of raised blood pressure compared to other vaccines as well as development of the features of capillary leak syndrome, with female gender being slightly more affected than their male counterparts.

Keywords: Covid-19, Covid 19 Vaccine, Covishield, Covaxin, Capillary Leak syndrome, Arterial blood pressure.

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Introduction:

In the ongoing battle against the COVID-19 pandemic, vaccination has emerged as a powerful weapon to curb the spread of the virus and mitigate its severe effects. While the global vaccination efforts have undoubtedly contributed to the decline in infection rates and improved public health outcomes, an intriguing and relatively unexplored facet has surfaced - the potential impact of COVID-19 vaccination on arterial blood pressure and the manifestation of capillary leak syndrome as a complication.

As we delve into this uncharted territory, it's imperative to acknowledge the dynamic nature of the COVID-19 landscape and the continuous evolution of our understanding.

COVID-19 Vaccination: A Beacon of Hope: The introduction of COVID-19 vaccines marked a turning point in the fight against the pandemic. Vaccines, such as those developed by Pfizer-BioNTech, Moderna, AstraZeneca, and others, demonstrated remarkable efficacy in preventing severe illness, hospitalization, and death caused by the SARS-CoV-2 virus. These vaccines primarily target the spike protein on the surface of the virus, eliciting a robust immune response.

Global vaccination campaigns, spearheaded by organizations like the World Health Organization (WHO) and national health agencies, have made significant strides in achieving widespread vaccine coverage. However, as vaccination efforts progress, a growing body of anecdotal evidence and emerging studies suggest a potential link between COVID-19 vaccination and alterations in arterial blood pressure, accompanied by the development of capillary leak syndrome in some individuals.

Arterial Blood Pressure: A Silent Player in Vaccination Dynamics: Arterial blood pressure, a key parameter in cardiovascular health, has been under the spotlight as researchers explore potential connections between COVID-19 vaccination and changes in blood pressure profiles. While the primary focus of vaccination is to stimulate the immune system's defenses against the virus, some individuals have reported transient increases or decreases in blood pressure following vaccination. A study conducted by Simonini et al. (2022)[1] observed a significant but temporary elevation in systolic blood pressure within 48 hours of COVID-19 vaccination in a cohort of hypertensive individuals. This finding raises questions about the mechanisms behind this blood pressure fluctuation and its potential implications for individuals with pre-existing cardiovascular conditions.

Capillary Leak Syndrome: Unravelling the Vaccine Complication Enigma: Capillary leak syndrome (CLS) is a rare but serious condition characterized by the leakage of plasma from blood vessels into surrounding tissues, leading to swelling and potential organ dysfunction. While CLS is not a common side effect of COVID-19 vaccination, isolated cases and reports have emerged, prompting further investigation into the potential association between vaccination and this syndrome. Recent study by Rosanna et al. (2022)[2] have documented instances of CLS occurring post-COVID-19 vaccination, with a notable emphasis on the mRNA vaccines. The authors suggest a potential immunological trigger leading to endothelial dysfunction and increased vascular permeability, contributing to CLS development. However, it's crucial to interpret these findings cautiously, considering the rarity of such cases and the need for broader population-based studies.

Navigating the Unknown: Challenges in Research and Surveillance: As the scientific community grapples with these emerging findings, several challenges hinder a comprehensive understanding of the relationship between COVID-19 vaccination, arterial blood pressure changes, and capillary leak syndrome. The rarity of reported cases and the need for large-scale, long-term studies pose significant hurdles. Moreover, distinguishing between vaccine-related effects and coincidental occurrences remains a formidable task. The temporal association between vaccination and observed changes in blood pressure or the development of CLS does not necessarily imply causation. Robust surveillance systems and thorough clinical investigations are essential to delineate the true incidence and mechanisms involved.

Globally, as per WHO dashboard data on 08th November 2023, there have been more than 77crores 18 lakhs confirmed cases of Covid-19 with more than 69 lakhs78 thousand deaths worldwide as reported to WHO. As regards vaccination, more than 1353 million vaccine doses have been administered worldwide.[3] As regards region wise positive cases of Covid -19 Europe had maximum number of cases which was around 27 crores followed by Western Pacific which had around 20crores of Covid positive cases closely followed by the Americas with more than 19 crores of the population falling victim of the pandemic. Southeast Asia had more than 6 crores of people affected. The least affected were the African continent with about 95 lakh population being affected by Covid-19.[4] As per Ministry of Health & Family Welfare government of India there are about 177 active cases of Covid -19 in India as on 09th November 2023 with over 4 crore positive cases discharged which is about 98.81% with about 5 lacs 33 thousand deaths with over 220 million vaccine doses administered.[5] In our state of Assam as on August, 2023, there are no active cases with more than 7 lakhs of cases got cured. In Guwahati city more than 5 lakh cases of Covid-19 positive cases were treated with almost 98% got cured.[6]

With the development of the vaccines there have been concerns and observations regarding the relationship between COVID-19 vaccinations and certain adverse effects, including changes in arterial blood pressure and the development of capillary leak syndrome leading to pedal edema. COVID-19 vaccines have proven to be an essential tool in curbing the spread of the virus and preventing severe illness. However, like any medical intervention, vaccines can be associated with various side effects. These effects can be influenced by various factors, including individual health conditions and vaccine types. The relationship between COVID-19 vaccination and such adverse effects is still an active area of research, The COVID-19 pandemic has challenged the global healthcare community to develop effective vaccines at an unprecedented pace. The rapid deployment of vaccines, such as those developed by Pfizer-BioNTech, Moderna, AstraZeneca, and others like Covaxin, Covishield, had offered a glimmer of hope in controlling the spread of the SARS-CoV-2 virus. As millions of people worldwide received these vaccinations, there have been numerous reports and concerns about potential side effects and adverse reactions, ranging from mild fever and fatigue to more severe outcomes. This introduction focuses on a specific aspect of these vaccine-related concerns: their potential influence on arterial blood pressure and the development of capillary leak syndrome, which may manifest as pedal edema (swelling of the feet and ankles). These vaccines which were developed basically focussed on stimulating the immune system to produce antibodies against the SARS-CoV-2 virus. Despite the crucial role these vaccines some reports have suggested that certain individuals had experienced transient increases in arterial blood pressure following vaccination, possibly as an immune response. Additionally,

there have been anecdotal accounts of individuals experiencing capillary leak syndrome. This leakage can lead to pedal edema, in which there is swelling in the lower extremities, particularly the feet and ankles.[7] Keeping these adversities into consideration this study was undertaken from amongst the cases admitted in a Covid care centre of Guwahati. These types of research study have not been undertaken before in this part of India. Moreover, there were some studies which found some strains of the vaccines causing high blood pressure.[7] These evidences prompted us to carry out the research study

Methods:

The sample size was calculated using the formula for the sample size calculation of proportions and prevalence which is given by the formula $n = Z^2 p (1-p)/e^2$ where Z= confidence level at 95%(standard value of Z=1.96) 'p' estimated prevalence or proportions of the project area 'e' is the range of CI. The value of prevalence was taken to be 50% as Covid-19 is a novel disease and not much is known about the prevalence of the disease and range of CI was taken to be 95% after which the value of n came out to be 104. In this study we have n=802. So, 802 Covid positive cases (which were determined by Rapid test or by RTPCR) vaccinated individuals after first dose or second dose were taken up as cases for the study.

The written informed consent from the cases were taken in a language they could understand.

The IEC permission was taken from the institutional ethical committee Gauhati Medical College and Hospital, Guwahati.

The study is a cross sectional study and the period of data collection and evaluation from Dec-21 to Dec-22. The cases admitted in the covid care centre in Sarusajai which was under Gauhati Medical College were from all the corners of Guwahati city. The cases selected were by simple random sampling with lottery with patients bed numbers was taken on a particular day and accordingly with the selected lot questionnaire was filled up and then the physical check-up was done. The cases were enquired about their blood pressure status and any symptoms of kidney or urinary tract disease. The physical examination was carried out mostly within 48 hours after their admission. A proper history was taken specially for the vaccination types, date of vaccination, number of vaccines taken, whether any changes in blood pressure readings, facility for home blood pressure monitoring, any swelling of feet, hands or ankle post vaccination, It was also enquired from the cases about their past history of hypertension, kidney disease, hypothyroidism. It was also found out regarding the compliance of the antihypertensive and other regular medications. The blood pressure was measured using digital blood pressure machine which was calibrated regularly with the sphygmomanometer. Different sizes of blood pressure measuring cuffs were used considering the heterogeneity of the cases in supine position after a minimum rest period of 5 minutes. The pedal edema was checked by the conventional procedure of finding out edema as described in Hutchisons clinical methods textbook.[8] Patients who were having chronic conditions like hypertension, T2DM or any other chronic illness were also included in the study. Cases whose age were less than 18 years were not included as they were not vaccinated. Cases with symptoms of mild Covid as well asymptomatic cases who were admitted in the Covid care centre were taken up for the study. There was no gender preference of the cases. The patients who were not willing were left out.

Those patients who were being referred to tertiary care centres for further treatment following complications of Covid -19 were not included in the study.

After the questionnaire were filled up and history taken it was found that 25 persons of the cases had not received/ taken covid vaccination. So they could not be part of the study.

After the data was collected it was analysed using MS-Excel software. Analysis of variance test (t-test, one tail) was done along with determination of the 'p' value and Pearson's coefficient of correlation.

Results:

The study investigated the post-vaccination status of arterial blood pressure and the development of capillary leak syndrome (CLS) in 802 patients admitted to the Sarusajai COVID Care Centre under Gauhati Medical College, Guwahati. The primary objective was to explore any potential associations between changes in blood pressure post vaccination status, and the occurrence of CLS leading to ankle or feet edema in vaccinated individuals who had tested positive for COVID-19.

After analysing the data of all 802 COVID-positive cases, the breakdown of religious affiliations revealed the following distribution: 537 individuals followed Hinduism, 112 followed Islam, 60 were Sikhs, 48 adhered to Christianity, 32 practiced Jainism, and 12 followed the teachings of Lord Buddha.

Further inquiry into the types of vaccines administered to the vaccinated individuals revealed the following breakdown: 549 individuals received Covishield (the AstraZeneca vaccine manufactured by the Serum Institute in Pune), 234 individuals received Covaxin (an indigenous vaccine produced and marketed by Bharat Biotech in India). Additionally, there were cases in which 19 individuals received other vaccines, including Sputnik-V (the Russian vaccine), Mederma vaccine, and Pfizer vaccine. Notably, many of these 19 cases had been residing in countries where these vaccines were administered, and they returned to India following the unfortunate demise of a family member, subsequently contracting COVID-19.

This study aimed to elucidate any potential correlations between vaccination status, blood pressure changes, and the development of CLS in COVID-19-positive patients, with a particular focus on the types of vaccines received by the study participants.

Name of Vaccine received	Number of cases who received the vaccine	Percentage of the specific vaccine
Covishield	549	68.45
Covaxin	234	29.17
Others	19	2.36

Table1: Percentages of the different types of vaccines received by the cases.

Significantly, out of the total cases, 194 individuals received the first dose of the vaccine, while 608 persons received both doses of the vaccine. So, the percentage of affected persons after first dose of the vaccination is 24.18% whereas after second dose it is 75.82%. This division

enabled us to distinguish between those who experienced changes in blood pressure or the development of capillary leak syndrome following the first dose and those who exhibited such effects after receiving the second dose.

Amongst the cases, 463 (57.73%)were males and 339(42.26%) were females.

AGE(YEARS)	MALES	FEMALES
18-20	16	7
21-30	146	56
31-40	154	139
41-50	53	79
51-60	51	20
61-70	22	20
71-80	14	12
81-90	7	6
91-100	Nil	Nil

Table 2: Age wise distribution of the cases

On analysis of the number of cases as per the age of getting affected it is found that majority of the males (31.53%) of the cases affected were in the age group of 21-30 years whereas 33% were in the age group of 31-40 years which implies that of the total 463 males affected almost 65%of the cases were from the age group of 21-40 years which maybe that in this age group people move outdoors and comes in contact with people which might have contributed to them being getting affected by Covid-19 more than other age group persons.[9]

Type of Food	Number of cases		Males	Females
Vegetarians -	94	Out of the vegetarians -	55	39
Mixed diet	708	Out of the cases taking mixed diet	367	341

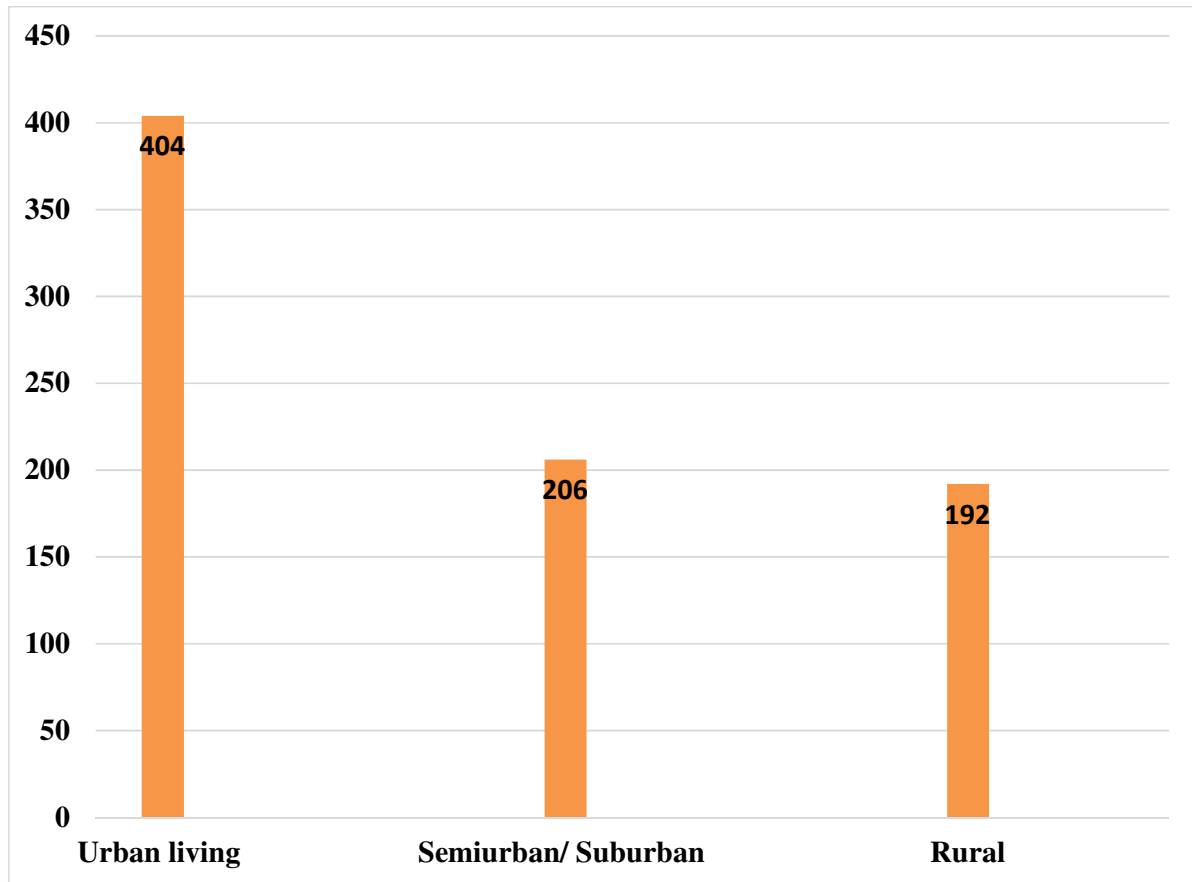Table 3: Table depicting the dietary pattern of the cases

Fig: 1 Bar diagram depicting the places of living of the cases.

When the cases were enquired about the places of living most of them 50.37% were from urban locality, 25.68% were from semi urban locality and 23% were from rural background. Most of the cases presented to the covid care centre with no symptoms. Some of the cases had mild fever as the only presenting complaint in addition to the positive status of Covid. There were a sizeable number of cases who complained of only dry cough and some cases presented with complaints of cough and fever.
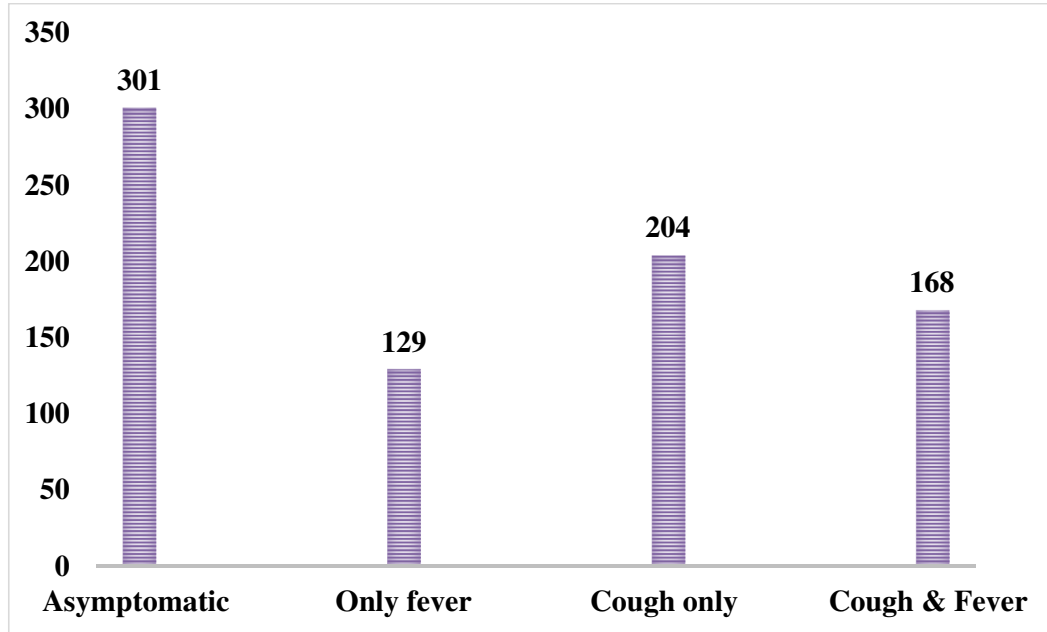
Fig:2 Bar diagram depicting the modes of presentation of the cases
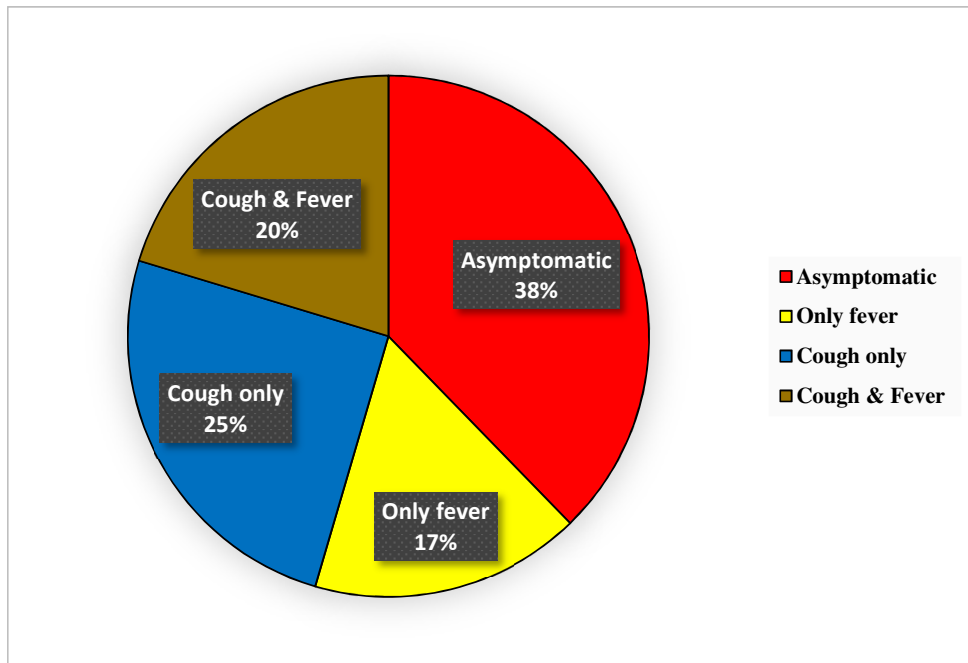

Fig: 3 Pie diagram showing in percentages the presenting features of the cases.

The highest systolic blood pressure recorded amongst the cases was 184 mmHg whereas the highest diastolic blood pressure recorded was 106 mm Hg. On the other hand, the lowest systolic blood pressure recorded was 91mm Hg whereas the lowest diastolic blood pressure recorded was 68 mmHg. The mean of the systolic pressure was 128 mm Hg whereas the mean of the diastolic BP was 87 mmHg respectively. The standard deviation of systolic blood pressure was 2.58 for systolic and 2.34 for diastolic.

Among the individuals who received the Covishield vaccine, a total of 228 were found to be hypertensive, comprising 135 males and 93 females. So these number of 228 cases constitutes approximately 28% of the overall vaccinated cases and 42% of the cases among Covishield vaccinated. Upon further investigation, it was discovered that among these 228 cases, 79 individuals had a pre-existing history of hypertension and were already on antihypertensive medication, with only 4 of them having a reported history of poor compliance with their treatment regimen. This suggests that around 34% of the individuals with hypertension had a pre-existing condition.

In the remaining 149 cases, which is almost 65% of the cases,32 individuals began experiencing elevated arterial blood pressure after the first dose of Covishield, with both systolic and diastolic blood pressure values rising. In contrast, the other 117 cases developed hypertension after the second dose of Covishield, with a notable increase in systolic blood pressure compared to diastolic blood pressure. The rise of systolic blood pressure was ± 8.78 mm Hg. In case of diastolic blood pressure, the average increase was by ±2.56 mm Hg. It is to mention here that a significant number of individuals who reported high blood pressure after the first and second doses of Covishield had a family history of hypertension among their first-degree relatives.

It is essential to highlight that all individuals who were identified with high blood pressure were recipients of the Covishield vaccine, while no such issues of raised blood pressure were reported among those who received vaccines from other companies. Additionally, there were no other associated signs or symptoms observed in these hypertensive patients.

	State of Blood pressure	Number of cases	Males	Females
Total number of cases -802	Total cases of raised blood pressure detected	228	135	93
	Cases with prior hypertension	79	38	41
	Cases with raised BP after first dose of Covishield	32	22	10
	Cases with raised BP after second dose	117	68	49

Table 4: Table showing the gender distribution of the hypertensive cases after the doses of Covishield.

There is a slight female preponderance with females affected after Covishield vaccine about 63% of all the female hypertensive cases whereas males are close by only at about 59%.
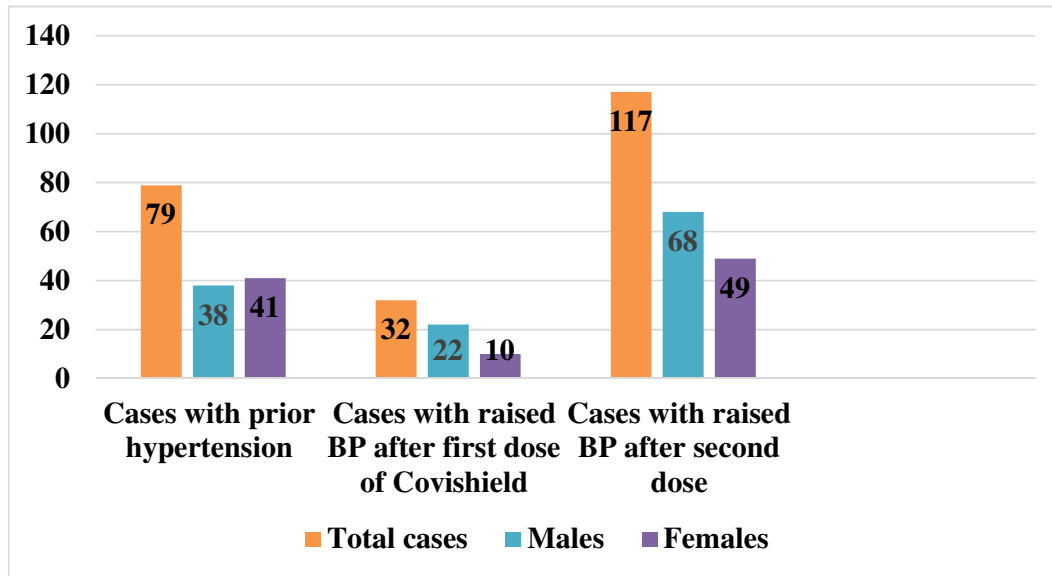

Fig 4: Bar diagram depicting the gender distribution of the raised BP cases

In the case of the persons with pedal edema, altogether 11 persons were detected to have pedal edema with 6 amongst them had pedal edema before of which the causes maybe attributed to hypertension, hypothyroidism, anemia and other causes which would have required further investigation. Amongst the 11 persons with pedal edema 7 were females and 4 were males. Those 5 cases who complained of post vaccination edema, 3 were females and 2 were males. The edema developed were pitting type of edema mostly bilateral suggestive of any systemic cause maybe like capillary leak syndrome. The edema developed after vaccination amongst the 5 cases 3 of them received Covishield and 2 received Covaxin. Those cases in whom vaccine was Covishield one of them have had pedal edema after first dose of the vaccine and had the edema even after the second dose but was non progressive. The other two had pedal edema following the Covishield second dose which was also confined to the ankle and feet. The persons with pedal edema following Covaxin was after second dose, which was also confined locally to ankle and toes. However, in all the cases both the feet were affected.

The coefficient of correlation was calculated between systolic and diastolic BP reading of the hypertensive cases who received Covishield vaccine both who received one dose of the vaccine and for those who received 2 doses of the vaccine and the result showed positive correlation after the second dose with Pearson's coefficient of correlation $r = 0.74$. This suggests that with the rise of systolic BP the diastolic also has a tendency to rise, which maybe the consequence of vaccination by Covishield.

Doses of Covishield	Pearson's Coefficient of Correlation (r)
After First dose	0.02
After Second dose	0.74

Table 5: Table showing the coefficient of correlation between systolic and the diastolic component of the arterial blood pressure of the persons who received Covishield vaccination.

The 'p' value was determined using single factor Anova with respect to blood pressure and Covishield vaccination dose (first and second dose) and it came out to be 0.0003 (≤0.05) which fails to reject the null hypothesis and so there is statistical significance between rise of arterial blood pressure and the Covishield vaccine dose.

Discussion:

The results highlight that of the 802 cases who were vaccinated in the period as mentioned in the methods part were the cases who were part of the study.

Buso G et al[10] published an article between Covid19 vaccines and increased blood pressure. As per this study, approximately 65% of the world's population has been fully vaccinated. As the number of persons who received the Covid vaccines there was excellent safety & efficacy of all the vaccines & there were no clinical trials which showed no significant correlations between vaccines and hypertension. The blood pressure measurements pre-vaccination was not available for the majority of patients but some amongst them reported well controlled home blood pressure before vaccination.

Meylan et al[11] in his study reported that within a few minutes of the vaccination there was rise of blood pressure amongst the vaccinated individuals. Mostly with the Pfizer and Moderna vaccine. But in our study the positivity of the cases was seen post vaccination as well as out of the 827 cases 802 had taken the vaccine which is about 96%of the cases who contacted the disease even after 2 doses of the vaccine. So vaccines provided very little protection although the severity of the symptoms were very less compared to the cases who did not take vaccination. As per our study most of the cases had taken vaccination sometimes prior to getting infected so immediate rise of blood pressure post vaccination could not be assessed except during enquiring about the case history.

In our study as stated majority of the cases/ participants received Covishield vaccine followed by Covaxin. In a study by Zappa M et al[12] it was stated that post Covid 19 vaccination was associated with higher probability of rise in blood pressure. However, in our present study it was found that around 34%of the cases had pre-existing hypertension and almost all the cases had good compliance with antihypertensive.

In a large cohort study of health care workers specifically done by Simonini et al which reported an increase in blood pressure in 8%, with new diagnosis of hypertension in 2% plus there was an increase in antihypertensive therapy in 11% of the subjects, but in our study 34% of the cases had prior hypertension and was on antihypertensive and almost 65 % had rise of blood pressure (both systolic and diastolic) and was more common with mRNA vaccine Covishield which might be due to immunogenic reaction which can be chiefly   attributed to

downregulation of ACE2 and imbalance between different angiotensin levels leading to failure of the counter regulatory renin angiotensin system axis.[13]

In this study, there was no definite age group among adults where the blood pressure was elevated but in the study by Bouhanick et al[14] in Covid 19 infection the age of patients in uncontrolled hypertension ranged from 35 to 52 years.

In the observation made by Tran et al[15] in his study the conclusion was that increasing age was associated with decrease in blood pressure elevation whereas in another study by Meylan et al the median age of rise of blood pressure post vaccination was 73 years, whereas in our study there was no median age.

Our study has some semblance with the study report of Kaur et al[16] where it was observed that cases had hypertension post vaccination and there was no gender preponderance like the present study. In another anonymous study higher rates of blood pressure were found in older individuals,

The increase of blood pressure may be due to the events which occurred post vaccine injection and within minutes for some, the BP was raised because the time was too short for cellular uptake and translation of m RNA leading to interaction between S protein and ACE2 receptors further leading to downregulation of ACE2. The general symptoms of rise of blood pressure which may include a white coat effect as well as increase in sympathetic tone consequent to pain felt during the injection as well as stress response due to fear of injections. The delayed effect of rise in blood pressure could be due to failure of the counter regulatory RAS axis which was reported in some study. [17,18] The role of excipients such as polyethylene glycol present in vaccines can also be a possible link between BP increase and vaccine.

After lot of deliberations it was concluded by Pharmacovigilance Risk Assessment committee(PRAC) of European Medicine Agency that capillary leak syndrome should be listed as a new adverse effect of the vaccination with Astra Zeneca vaccine Covishield.[19] They further concluded that majority of the cases of CLS were women and majority of them had such kind of symptoms within four days of the vaccination. The cases who had CLS usually had acute limb edema, hemoconcentration, hypoalbuminemia and hypotension which are the symptoms of CLS and can lead to organ failure. In our case most of the patients were women who complained of swelling of ankles and feet. Some even complained of sudden swelling of the arms and legs along with abrupt weight gain in days after immunisation. Isolates cases also complained of dizziness which can be linked to low blood pressure. In these cases of CLS there is leakage of fluid from the capillaries which may lead to hypoalbuminemia, edema, hypotension, hemoconcentration.

Conclusion:

The discovery of the Covid vaccines no doubt was a boon for the cases of Covid for it saved many lives of Covid patients and restricted the onset of the complications but the covid vaccines were not averse to complications. Amongst the main complications were the two most serious complications were rise of blood pressure post vaccination and capillary leak syndrome, in case of the complication in which both systolic and diastolic BP was raised but compared to systolic diastolic BP increase was less.

It was found out that those persons who were vaccinated with Covishield had more incidences of rise of blood pressure. In comparison to first dose the persons who received two doses of the vaccine had more rise with systolic blood pressure which maybe acute or chronic. Acute cases were immediately after vaccine was administered which maybe due to sympathetic overstimulation following pain while administering the dose of vaccine, whereas the chronic rise of blood pressure were consequence of failure of RAS following downregulation of ACE2. There was slight female preponderance amongst the cases as regards vaccination after Covishield. The reason could not be assessed only hypothesis could be increased sympathetic activity but it is entirely personalized.

There was cases of swelling of ankle and feet. Out of all the cases 63% were females. The swelling was bilateral and was non progressive. The swelling of the feet and ankle was encountered in some after first dose and second dose of vaccination. The cases with swelling of the feet and ankle had taken Covishield and Covaxin. There were no other manifestations like swelling of hands, hypotension and other symptoms of capillary leak syndrome.

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