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The Relationship Between Takosubo Cardiomyopathy and COVID-19

Cardiomyopathy is a cardiac disease in which the heart experiences severe swelling of its cardiac muscle. While experiencing a wide range of symptoms, the heart itself has a very difficult time pumping blood into the rest the of the body. There are variants of cardiomyopathy, such as hypertrophic cardiomyopathy, dilated cardiomyopathy, arrhythmogenic cardiomyopathy, etc. However, the variant of cardiomyopathy being discussed in this paper will be Takosubo Cardiomyopathy, otherwise known as Stress Induced Cardiomyopathy and or Broken Heart Syndrome. What makes Takosubo cardiomyopathy different is how when a patient is experiencing an episode, it is due to a severe amount of emotional stress. This stress then triggers the left ventricle of the heart to swell and have difficulty ejecting blood to the rest of the body. To add, the second topic of this paper, the Corona-19 virus, a SARs virus was the biggest upset during 2020, triggering a worldwide pandemic. This virus' target was primarily the elderly, those with compromised immune systems or those with diseases such as cancer or respiratory disorders. This does not exclude its effect on young adults and teenagers however, as they were targets themselves but on a lesser scale. Takosubo Cardiomyopathy (TCM) and COVID-19 have a relationship with one another such that if one were to develop Covid, while also having TCM it would be not only more difficult to recover but they are more susceptible to getting COVID.

Takosubo Cardiomyopathy, as briefly stated, involves the swelling of the lower and larger (of the two) ventricles of the heart, on the left. The reason for the name Takosubo is due to

the left ventricle appearing like the shape of the Japanese octopus cape, a takosubo. However, there is a misconception to be address when talking about TCM. The swelling does not mean increased volume for blood to enter, but just the opposite. This severe amount of swelling means there is still the same amount of blood wanting to exit the body as before an episode, but due to said swelling there is a narrower hole it must pass through. This variant of cardiomyopathy can be detected through genetics of one's family or simply through the constant amount of emotionally or psychological stress paired with radiology testing. (Wexler, et al. 2009) The symptoms of Takosubo cardiomyopathy can be quite similar to that of a heart attack, chest pain, shortness of breath, body aches, sweating, high blood pressure, numbness or tingling in the extremities, poor circulation leading to swelling in other areas, etc. Since there symptoms are very similar to that of a heart attack, a myocardial infarction is what most Takosubo patients come to the Emergency Room saying they have, when in reality it is TCM. (Wexler, et al. 2009) However, the most concerning symptom from TCM episodes is lack of blood flow, that is responsible for carrying oxygen to the rest of the body and organs that need that oxygen supply. (Pasqualetto, et al 2019) In one regard what makes Takosubo Cardiomyopathy so frightening is how one day a patient can appear perfectly normal and healthy, then the next moment they think they are having a heart attack and are "dying." (Pasqualetto, et al 2019)

Since November 10 of 2020 the Coronavirus has being diagnosed to nearly 51 million people and taken almost 1.3 million lives. The Coronavirus (Covid-19) is a flu-like disease that targets ones respiratory and immune system causing one to also lose their sense of smell and taste. However, there are cases where a patient can be positive for the Coronavirus while also having no symptoms. Typically, the infectious period for a positive Coronavirus case is 5 days after they received a positive test and or were exposed if they know where/who they got it from.

(John, et al. 2021) While being diagnosed with Covid-19 the body can experience a range of symptoms from sinus pressure, headaches and fever to shortness of breath, chest pain, loses senses and brain fog. An aspect of Covid making it even more deadly is how when bringing in another disease or pre-existing disease/disorder to the body while only being harder to handle as the coronavirus attacks the body's ability to fight pathogens very quickly. (John, et al. 2021)

During the pandemic it was very evident that general anxiety and depression rates increased. For a long time the public's feeling towards mental health (anxiety, depression, etc.) ranged from "everyone has anxiety" to "You're fine, just get over yourself". However shortly after the pandemic started there was a major attitude shift in looking at mental health as almost every adult and child was dealing with some form of stress. "Uncertainty and isolation have been linked to mental health problems. Uncertainty surrounding the COVID-19 pandemic has the potential to trigger mental health problems." (Shah, et al. 2020) A study conducted, using an online questionnaire allowed people all over the world to see just how people were experiencing, stress, anxiety and or depression. During the full lockdown portion of COVID (spring 2020- late summer 2020) this study showed that of the 624 people that completed a questionnaire pertaining to stressors related to the pandemic, "50.9% showed traces of anxiety, 57.4% showed signs of stress and 58.6% exhibited depression." (Shah, 2020) There were variants of stress with anxiety in one group with anxiety and depression in others. There was a combination of all three diagnoses in females, ages 18-24 years, who were not in a relationship compared to those females of the same ages, who were married, who only experienced general anxiety. However, in a different light those without jobs experienced both stress and depression and students of any age showed signs of stress and depression. This of course makes sense as those without jobs, during a time where you cannot go out into public, became stressed about making money and

growing concerns on how they would be able to keep their homes, feed themselves and their families and get any other necessities. As students, we can each describe, personally, how the pandemic played a role in our lives, the added stress of having to going from learning in a classroom every day to suddenly online. Mounting concerns on only being able to have email contact with a professor enhanced stressors as we worried how one could connect with a professor if something urgently arose. Gone were office hours, in person contact of any sort, some professors just stopped teaching and moved right to power points and pre-recorded lessons. Students were left to "figure it out." (Shah, et al. 2020)

For those with larger families it was found that the stress, anxiety and depression rates were lower. This makes sense as by design the larger the family the more people there are to talk and spend time with, and more people to talk to about worries or anxieties. Contrast that to those in smaller families or only children who had far fewer conversational supports. (Shah, 2020)

Finally, another conclusion made from this study was how the lack of any form of exercise resulted in an increase of any of the three mental health problems. Biologically, it is because the more you exercise the more endorphins you produce in your brain and thus get pumped through the rest of the body. Specific stressors described in the article that produced the results were "… longer quarantine, fear of infection, frustration, boredom, inadequate supplies, inadequate information, finical loss and stigma." (Shah, et al 2020) Surprising or not, these symptoms were similar to that of the first SARs outbreak back in 2004. To further this, once COVID was identified as a SARs virus, as well as identified as a pandemic, those who experienced the 2004 pandemic exhibited symptoms of Post-Traumatic Stress Disorder (PTSD). The symptoms of PTSD were shown to more prevalent and increased when a period of quarantine was extended or when the person in question was diagnosed/around someone who

had COVID. Finally, there is the inclusion how there is a requirement of studies and trials regarding mental health to show the fullest toll the pandemic has inflicted on the population. (Shah, et al. 2004)

As previously stated, the symptoms between the Coronavirus and Takosubo Cardiomyopathy do have some overlap with one another, but also with myocardial infarctions. (John, et al. 2021) When looking at statistics of both diseases and specifically looking at gender, there is little disparity seen within both. If there were to be any argument, it could be made that TCM is slightly more common in older women, while COVID in men. (Desai, et al. 2020) However, this statement is subject to further research and determination. (Desai, et al. 2020) Since it is known that Takosubo cardiomyopathy has a heavy psychological and emotional stress component attached to it, it was no surprise that when researching patients who Covid and TCM, the Takosubo cardiomyopathy was actually developed in the form of Post-Traumatic Stress Disorder. Again, this can almost be something expect as the pandemic itself was such a stressful time for the entire world, even for those who never got Covid itself. Watching your friends, family or even people your own age getting so gravely ill and dying does cause emotional strain to someone's mind. Not knowing that if you get Covid, you may die is a horrible thought to bear. It also comprehending how fast someone goes from being okay, to gravely ill is quite traumatic. This is huge component as to why the general rate of Takosubo Cardiomyopathy diagnoses increased since the pandemic started. To add to this, patients with Covid already and bearing no heart history have been seen more likely to develop TCM, than patients without ever having COVID. (Fisal,W. 2019) With these increased numbers, also comes with the increased inflammatory markers seen in Covid/TCM patients. More or less the body has stages of

responding to infection or just knowing something isn't right, and one of those is an inflammatory response. (Techasatian, et al 2022)

When looking at diagnosing and treating patients, it is almost "easier" to diagnose and treat Covid-19 patients then it is to treat and diagnose Takosubo Cardiomyopathy patients. The protocol of Covid patients is a PCR nasal swab and then a range of antibiotics/treatments can be offered to the patient. Screening tools are beneficial for Covid patients as it allows for doctors, nurses and physician assistants to see how damaged a patient's lungs may be, as well as their heart, brain, other organs to scan for any residual damage. In terms of the quarantining time, of the course of the past two years things have changed. The isolation time for a patient diagnosed with the Coronavirus shifting from fourteen days to now a maximum of five days. The example alone is also an example of how science, this obviously includes medicine, is always changing. For an incoming patient, without knowing they have TCM it is typical for them to be screened for a heart attack first based upon the symptoms. However, the primary way to detect if a patient has Takosubo Cardiomyopathy is through the use of an echocardiogram (ECHO) machine. An echocardiogram is more or less a sonogram of the heart to look at the pumping function, check for sizing of the ventricles, atrium, arteries and check for leakage. "The use of hand-held point care ultrasound is extremely beneficial for rapid screening of the cardiac structure and function." (Moady, et al. 2022) The use of an MRI, angiogram (catheter through the arm or leg), and or CAT scan can be useful, but echocardiograms have proved to be the most beneficial. (Belli, et al. 2021) When considering oral medications, there is nothing that necessarily used directly for Takosubo Cardiomyopathy. However, traditional beta blockers used to lower blood pressure, blood thinners (also used to aid in lowering blood pressure) and even ACE inhibitors, used in cardiac recovery, can be prescribed to help treat the symptoms, lowering the risk of a retuning

episode. Again, it is important to keep in mind that the use of anti-depressants as well can also help keep the patient's mental state stable and keep them from becoming too emotionally stressed and falling themselves in a TCM episode.

In regard to specific case studies, there were three patients experiencing Takosubo cardiomyopathy before being admitted to the hospital in Italy. All three cases for these patients were admitted due to the severe respiratory distress from also battling Covid at the same time. Besides a history of diabetes or high blood pressure the three patients were in good health prior to being admitted. There was even a lack of cardiovascular history in all three cases, but again this goes back to how it is very common for Takosubo Cardiomyopathy patients to have no cardiac history prior to their first episode. TCM aside, the three patients all experience some forms of fever, coughing with shortness of breath and varying chest pain around ten days before they were admitted and testing for Covid via nasal swab. Appropriate blood and screening tests were performed, followed by appropriate drugs were administered. One of which being the staple drug to treat Covid patients, hydroxychloroquine. A diagnosis from the lunch scans in all three patients was the consolidation of the lungs, meaning there are small air pockets in the lungs that can be filled with blood, water or even pus. For this reason, the hydroxychloroquine was also prescribed. To keep up on a day to day basis of the patients' heart functions and electricity there was an EKG done every day to monitor changes. The first patient in the study was 84 years old and male. Due to a dangerously high blood pressure of 220/100ppm (standard being 115/75) he was treated with beta-blockers to bring it down as well as an oxygen filled nasal cannula to keep his oxygen levels up. Although, scheduled for an angiogram, due to this patient's damaged lungs from battling Covid and then pneumonia the procedure was postponed. It was later performed and was a success, however if Covid wasn't in the picture perhaps it could've been

performed sooner. The second patient was 85 years old and a woman who was admitted to the ICU due to severe case of Covid. Growing to a point of her lungs failing, she was ventilated. Sadly, the patient later died due to her left ventricle swelling, but also her lungs completely failing in function. This was directly due to the TCM causing her left ventricle to not get the blood, therefore the oxygen to the rest of her body. This also combined with her lungs no longer being able to pump air on their own caused her to pass. The third and final patient of the case study was an 81-year-old male, who came into the emergency room with Covid and after an EKG a left ventricle low ejection fraction. More or less meaning his left ventricle was at the beginning stages of swelling and needs to be treated. Once his pneumonia was treated, an appropriate angiogram was performed, and he recovered. The point in addressing this article was to show how the effects of Covid can make patients more suspectable to developing Takosubo cardiomyopathy, but furthermore make the recovery time from much more difficult. (Pasqualetto, et al. 2019)

In another study conducted, the name of Takosubo Cardiomyopathy was altered slightly to "COVID-19 social isolation induced Takosubo Cardiomyopathy." The following article by Jon Rivers and Joshua Ihle discusses how the specific action of isolating via social distancing caused a patient enough strain to develop Takosubo Cardiomyopathy. Through various testing the ballooning of her left ventricle was indicative of TCM. To this specific patient, she was experiencing the pandemic and isolation alone in her house and the inability to see her family began to weigh on her mentally. This is just an example of how in one case specifically, being in isolation for so long can do a lot of damage on someone's physical and mental health. (Rivers, Ihle, 2021)

When we look at gender disparity, there are certain cases where a disease or disorder can have more diagnoses in men than women and vice versa. There are also diseases and disorders that show less, or little gender disparity. In the case of Takosubo Cardiomyopathy, there is a report of more women being diagnosed than men, most specifically elderly women. However, due to men and women presenting differently, resulting in varying expression there can be an argument made as to whether or not the disparity is completely accurate. A study conducted across Germany and Austria included 324 patients in total. One of the questions aiming to be answered or a topic of discussion, was is it true the TCM is more common in women? Specifically, more common in women, post menopause. The decision to include in the question, post-menopause is due to the change in hormone levels in women during that period of time. In this study there were 296 females and 28 males included. There were classifications in the study falling under "trigger events… emotional and physical stress" followed by varying physical symptoms. (Schneider, et al. 2011) For this specific study the common symptoms found were chest pain in about 72 percent, shortness of breath in 15 percent of patients and fainting/lightheadedness in three percent of the total amount of patients. In trying to determine if there is a major difference between male and female patients of TCM, for this particular study they reported little difference regarding the age or the timing of symptom presentation. However, one noted difference was the recorded chest pain primarily in women rather than men. For men, the majority of patients being admitted was due to another cardiac episode, that was not TCM. Another distinguishing factor referring to the types of triggers for stress was, that in this particular study, males flagged more triggering events paired with physical stress whereas for females, either emotional or non-specific events were flagged higher. Of course, this is only one study therefore the actual presentation and results may be different somewhere else in the world,

but it is still proposing that Takosubo Cardiomyopathy is more likely in older women. (Schneider, et al. 2011)

Continuing on the subject of gender disparity in Takosubo Cardiomyopathy cases. A question was raised specifically regarding female estrogen levels and how being in post-menopause, causing the estrogen levels to lower could possibly cause women to be more likely to get Takosubo Cardiomyopathy. For this specific study conducted, 18 female patients were included. Of the original 18, 16 of them were in post-menopause and two were not. There were physical triggers present in the patients being studied, but most prominently the stressors were emotional or psychological. (Bruce, et al. 2010) When the research was being conducted, none of the patients were on any form of Estrogen Replacement Therapy (ERT), which could help increase a post-menopausal woman's estrogen levels. The disadvantages to this therapy however do include not being helpful in treating other cardiac disease, but also can be associated with some increase of breast cancer diagnoses. With this in mind, the general treatment of Estrogen Replacement Therapy would need to be reconsidered and studied more before being used, especially on Takosubo Cardiomyopathy patients. Given also that no male patients were included in the study, there is less clarity in answering the question, is there a true disparity? The data from this research did demonstrate that ERT does need to be studied more as the post-menopausal women did develop TCM from a number of ways, but also that general Takosubo Cardiomyopathy treatment plans need to be studied and further developed. (Bruce, et al. 2020)

Based on the article by Kevin John, Amos Lal and Ajay Kumar Mishra, there was a study of 24 cases of patients who had been diagnosed with Covid-19 who then went on to be diagnosed with Taksoubo Cardiomyopathy. Two of the patients specifically stated they were experiencing emotional stress due to the pandemic, the quarantine/lockdown, etc. These stressors were named

the cause of their Takosubo Cardiomyopathy diagnoses. What made this study interesting was how it included the varying symptoms for these patients experiencing TCM. There was a report of ten patients in the study experiencing chest pain, while also experiencing a combination of dyspnea, fever, coughing, lightheadedness and diarrhea. (John, et al. 2021) There was the presence of only two patients containing heart symptoms and as well as COVID, but also there was a specific case of heart symptoms that further developed into TCM post admission into the hospital. Finally, there were two who after being in the hospital, also developed chest pain. This was likely due to the stress on their body from COVID, but also general stress of the pandemic. Sure enough, on the third day for one patient their left ventricle ballooned, resulting in their TCM diagnosis as well as for the second patient, the same occurrence only it happened a week after they were admitted. For the final study, 26 patients were included who had both TCM and the Coronavirus. (John, et al. 2021) As stated previously the primary tool in diagnosing not only the Takosubo Cardiomyopathy in these patients, but the previous cardiac symptoms as well, was an echocardiogram. The other findings in the echocardiograms where variant types of TCM, such as bi-ventricular and median, as well as reportedly low ejection fractions. Some of the other cardiac disorders found in these patients, using electrocardiography (EKG), were not limited to atrial flutter, an arrythmia that causes the atria (upper chambers) to beat or pump regularly, but much quicker than the lower chambers. There was atrial fibrillation which the only difference from atrial flutter is that the beats are irregular; besides these two there were wave inversions as well as elevated troponin levels. The take way from this is that elevated troponin levels, which could mean that a patient experienced a heart attack. On a positive note, when nine patients underwent angiograms (cardiac catheterization), there was no major evidence of “obstructive coronary lesions.” (John, et al. 2021) Within this article there was also reporting of patients that

were diagnosed with TCM but not COVID. Symptoms were consistent between the two of chest pain, similar EKG findings, high troponin levels, but no obstructions. However, the symptom that led to an eventual TCM diagnosis was that both women but were experiencing major feelings of stress and anxiety. The root to these feelings, for both women, was the ongoing pandemic and required self-isolation/quarantine.

Recovery from any major disease is going to be tough. The main concern with Post-Covid patients is keeping oxygen levels stable and high while also regaining any of their sense of smell or taste if it was lost, as for some Covid patients they never lose those senses if lucky. For those with Takosubo Cardiomyopathy, while it is important to physically recover, it is just as important to recover mentally and emotionally as to hopefully avoid other episodes. This can be done through any short of therapy and even the addition of anti-depressants. In terms of being physically monitored, checking the patient's blood pressure and respiratory function is going to be daily must if a full recovery is desired. In reference to imaging and scanning these Covid/TCM patients there was consistent scar tissue, lung damage while also being paired with reports of shortness of breath while exercising, but also when "relaxed." (Desai, et al. 2020) The immune system of a TCM patient, is typically weaker due to the amount stress (physically and emotionally/psychologically) being put on the body, which can cause them to be more susceptible for Covid. Once Covid has entered the body as well, it proves that it adds its own forms of severe stress, which can therefore result in the body being more susceptible to TCM flair ups.

While the Covid-19 pandemic was an overall very stressful time period in more ways than one, when combined with Takosubo cardiomyopathy in patients the odds for said patient do prove to decrease and the fight/recovery processes are much more difficult to handle. When

discussing imaging and treatments for Takosubo cardiomyopathy individually, there is definitely a need for improvement. As for now the prime way to diagnose TCM is through an echocardiogram, while also seeing if genetics is a factor being played. It is unfortunate when researching to see that while general TCM diagnoses have increases since the pandemic started, there is also a general increased level of anxiety diagnoses, TCM mortality rates. These mortality rates even higher when the patient also had been diagnosed with Covid. With all of this in mind, we can see there is a direct relationship between Takosubo Cardiomyopathy and the Coronavirus.

Annotated Bibliography

Atrial Flutter. (n.d.). Www.hopkinsmedicine.org. https://www.hopkinsmedicine.org/health/conditions-and-diseases/atrial-flutter#:~:text=Atrial%20flutter%20is%20a%20type

The following source includes the description of atrial flutter. Atrial flutter is a type of arrythmia that involves the upper chambers of the heart to beat regularly but at a much faster pace than the lower chambers. This can often be confused with atrial fibrillation where the upper chambers are still beating fast, but now also at an irregular rate. This source is helpful as these types of arrythmias as well as other cardiac disorders can be present along with TCM.

Belli, O., Ardissino, M., Bottiroli, M., Soriano, F., Blanda, C., Oreglia, J., Mondino, M., & Moreo, A. (2021). Emergency cardiac imaging for coronavirus disease 2019 (COVID-19) in practice: a case of takotsubo stress cardiomyopathy. *Cardiovascular Ultrasound*, *19*(1), 1–4. https://doi.org/10.1186/s12947-021-00251-4

The following article addresses a study done on a patient who was diagnosed with COVID-19, kept in the intensive care unit (ICU) and medical imaging they had done that was suggestive of Takosubo Cardiomyopathy. The patient being in their early fifties was intubated at one point experienced hemodynamic collapse in pressure. This is suggested of a failure or problem rooting in the left ventricle, also the root in Takosubo Cardiomyopathy. Imaging and scans were run to show there were wall motion abnormalities, ejection fraction calculations that fall under the Takosubo category and that even while being ventilated the patient experienced an event of Stress Induced Cardiomyopathy. One key point that the article pointed out was having an electrocardiogram machine at the ready by the patients room or bedside. Thus, this article can not only be helpful in showing how the Corona Virus and Takosubo Cardiomyopathy relate, but also be helpful in the discussion of the mechanisms used to diagnose Takosubo Cardiomyopathy itself.

Desai, Hardik D et al. “COVID-19 pandemic induced stress cardiomyopathy: A literature review.” *International journal of cardiology. Heart & vasculature* vol. 31 (2020): 100628. doi:10.1016/j.ijcha.2020.100628

The Corona Virus that began the later part of 2020 targets one’s respiratory system, which will ultimately have its effects on the heart. Through research and testing, this virus has also proven to show that when diagnosed, it can exacerbate any pre-existing diagnoses a patient may have (especially cardiac). In this article it was demonstrated that Takosubo Cardiomyopathy may also be present in patients after fighting COVID, while having previous no heart dysfunction in the form of Post Traumatic Stress Disorder. Within this specific article, there was the inclusion, that despite Takosubo Cardiomyopathy was very common in postmenopausal women, during the COVID-19 pandemic there was little disparity between genders. There was also the inclusion of how a study conducted that as more people were diagnosed with COVID-19, there was also an increase in Stress Induced Cardiomyopathy. This articles will help defend

how the COVID-19 virus does have an effect on the increased Takosubo Cardiomyopathy cases, even if the person never had COVID themself.

Fisal Khader, Wedad, et al. "COVID-19 and Its Relation to Takotsubo Cardiomyopathy." *Medico-Legal Update*, vol. 21, no. 3, July 2021, pp. 263–66. *EBSCOhost*, https://doi.org/10.37506/mlu.v21i3.2994.

What this article aims to answer and provide is the importance of increased studies on Takosubo Cardiomyopathy, as well as recognize that the patient could go under some cardiac testing and be presented as "normal" while still experiencing TCM. That there should be further study in treatment for TCM because at the current moment there is very little treatment option, besides intravenous infusion of medicine to force the heart to contract and release blood. There is also the prominent concern of how Stress Induced Cardiomyopathy is ultimately a disease of inflammation that stays with the patients for a period of time and any sort of inflammation with the cardiac system can cause a multitude of issues for the patient. Ultimately any sort of increase study in this particular myopathy could be helpful in learning how to understand it more, but in this research setting this article will be helpful in answering questions pertaining to medications for TCM, as well as the relationship with COVID-19.

Kuo, B. T., Choubey, R., & Novaro, G. M. (2010). Reduced estrogen in menopause may predispose women to takotsubo cardiomyopathy. *Gender Medicine*, *7*(1), 71–77. https://doi.org/10.1016/j.genm.2010.01.006

Estrogen level decrease in post-menopausal women and its possible effects on Takosubo Cardiomyopathy patients is the topic of this particle. It was found that more research needs to be done, but that also general TCM treatment ideas also need to be done. This article was most helpful in also showing the gender disparity among Takosubo Cardiomyopathy patients.

John, Kevin, Amos Lal, and Ajay Mishra. 2021. "A Review of the Presentation and Outcome of Takotsubo Cardiomyopathy in COVID-19". *Monaldi Archives for Chest Disease* 91 (3). https://doi.org/10.4081/monaldi.2021.1710.

The importance of this article about COVID 19 and its relationship with Takosubo Cardiomyopathy is how there also points to cases of increased TCM diagnosis just from the sheer stress of the pandemic itself. There were variant cases of Takosubo reported with also varying symptoms, for example some with chest pain and others without, but the common denominator being severe emotional stress. With this in mind, there was also the reporting of these Stress Cardiomyopathy cases being revered within the COVID 19 patients, resulting in a nonfatal outcome. Within this particular study, there were five fatal deaths in which the patients with the Corona Virus and Takosubo Cardiomyopathy could not get a reversal of their cardiac

failure and ultimately died. The article will help provide information on how the stressors of the pandemic were enough to cause a sizeable amount of the population to develop Takosubo Cardiomyopathy.

Moady, G., & Atar, S. (2022). Stress-Induced Cardiomyopathy-Considerations for Diagnosis and Management during the COVID-19 Pandemic. *Medicina (Kaunas, Lithuania)*, *58*(2). https://doi.org/10.3390/medicina58020192

This article includes how there are multiple cardiac diseases/disorders associated with the COVID-19 virus. Two including a myocardial infraction and myocarditis. There are others as well, but one of the rarer ones is Takosubo or Stress Induced Cardiomyopathy. What was found was this myopathy was commonly diagnosed when the patient was "acutely infected" or was a secondary response to any stressors they had been feeling before, during or even after presenting with the Corona Virus. The other main target this article wished to highlight was the means of diagnosing Stress Induced Cardiomyopathy during the pandemic. One of the most useful tools was the echotrocardiogram, to provide an ultrasound of the heart and ultimately see the left ventricle of the heart swelling like a balloon. With this article a discussion can be made as to what and how a patient can be diagnosed with Takosubo Cardiomyopathy while also having COVID or even not having the virus, but needing answers to their symptoms.

Pasqualetto, Maria Cristina, Eleonora Secco, Manuele Nizzetto, Moreno Scevola, Lorella Altafini, Alberto, Cester, & Fausto Rigo. (2020). Stress Cardiomyopathy in COVID-19 Disease. *European Journal of Case Reports in Internal Medicine*. https://doi.org/10.12890/2020_001718

In this article there is information about three cases of Stress Induced Cardiomyopathy while the patients also had COVID. Within the three cases, they had previously presented and had been treated for diabetes, but were otherwise healthy before being diagnosed with COVID. Before admittance to the hospital, they had the standard flu symptoms of a cough and fever, only to be admitted after a positive nasal swab COVID test. There were routine lung scans done as well to show evidence of consolidation within the lungs. Out of all three patients, one did unfortunately pass due to insufficient oxygen levels, while the other who did have runs of intense high blood pressure, low oxygen and the textbook ventricle ballooning did survive. The use of this article will be towards answering the question of how to treat a patient for COVID while also managing this type of cardiomyopathy.

Rivers, J., & Ihle, J. F. (2020). COVID-19 social isolation-induced takotsubo cardiomyopathy. *Medical Journal of Australia*, *213*(7), 336. https://doi.org/10.5694/mja2.50770

This article breaks down briefly one specific patient that was admitted to the hospital due to Takosubo Cardiomyopathy following major emotional stress. The stress from the pandemic as well as living along and not being able to see her family finally got to her physically and this article just helps further show how emotional and psychological stress can take on physical symptoms in the body.

Schneider, B., Athanasiadis, A., Stöllberger, C., Pistner, W., Schwab, J., Gottwald, U., Schoeller, R., Gerecke, B., Hoffmann, E., Wegner, C., & Sechtem, U. (2013). Gender differences in the manifestation of tako-tsubo cardiomyopathy. *International Journal of Cardiology*, *166*(3), 584–588. https://doi.org/10.1016/j.ijcard.2011.11.027

The following article is about gender disparity in TCM. Is it truly more sided in women then men? The goal of the article was to study a group of a little over 300 people and determine whether TCM was more prominent in men or women, but specifically post-menopausal or older women.

Shah, S.M.A., Mohammad, D., Qureshi, M.F.H. *et al.* Prevalence, Psychological Responses and Associated Correlates of Depression, Anxiety and Stress in a Global Population, During the Coronavirus Disease (COVID-19) Pandemic. *Community Ment Health J* **57,** 101–110 (2021). https://doi.org/10.1007/s10597-020-00728-y

This article demonstrates how the pandemic had an overall increase in anxiety, stress and depression rates in multiple ages, but also many different lifestyles. It comes into detail as to what those groups of people are and how it is important to realize that mental health is just as urgent to treat and manage as any other health problem. The following article was helpful in proving how general increased anxiety and stress also was consistent with the increase in TCM diagnoses.

Techasatian, Witina, et al. “Characteristics of Takotsubo Cardiomyopathy in Patients with COVID-19: Systematic Scoping Review.” *American Heart Journal Plus: Cardiology Research and Practice*, vol. 13, 2022, p. 100092., https://doi.org/10.1016/j.ahjo.2022.100092.

The purpose of this article is to show the characteristics and statistics on people with TCM and COVID 19 and also how it relates to people who had the virus, while also being diagnosed with TCM had a much more difficult time dealing and recovering. In particular, there was more difficulty with the patients heart and lungs recovering from the duel damage of COVID and the left ventricle ballooning. Specifically, there was increase in mortality rate in patients diagnosed with TCM and COVID, as well as an increase amount of inflammatory markers which is a defense mechanism when the body is trying to fight off an illness only in this case the markers in heavily found within the respiratory and cardiac systems.

Wexler RK, Elton T, Pleister A, Feldman D. Cardiomyopathy: an overview. Am Fam Physician

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The following article contains a useful overview about cardiomyopathy disease. There is two ways one can develop cardiomyopathy, genetically (being the primary way) or through a toxic environment/ severe inflammation. There was the inclusion of the different types of cardiomyopathies being, dilated cardiomyopathy, hypertrophic cardiomyopathy, restrictive cardiomyopathy, takosubo cardiomyopathy and arrhythmogenic right ventricular cardiomyopathy. It is normal for there to be an absence of symptoms with these myopathies, however when they do present they are similar to that of a myocardial infarction. Such symptoms include shortness of breath, chest pain, fatigue, coughing, etc. This article will be helpful in defining what cardiomyopathy is in general terms before getting more specific into the Stress Induced Cardiomyopathy variant. This will be done while also emphasizing the importance of genetic testing and possible treatment options for those diagnosed.