Introduction

As humanity has evolved so do the diseases that infect millions every year. The types of diseases vary from the strange, to the rare, and to the common. One of those diseases is considered benign when it first manifests, but the options to treating the disease are extreme. That disease is known as gallbladder disease (GBD). GBD has appear in my own family, my grandmother and all three of her children, one who is my father, all had GBD and had to have their gallbladders removed. This trend is evident of something greater than a simple coincidence, but does the reappearance of gallbladder disease in my family's history point toward a genetic condition?

Research question

Does the reappearance of gallbladder disease in my family's history point toward a genetic condition or was it the result of accumulating environmental factors?

Background and Literature Review

The gallbladder is a small organ located underneath the liver. It stores the bile produced within the liver, which empties out after eating to help in breakdown of fats. Sometimes the gallbladder becomes ineffective resulting in the manifestation of GBD. The article written by Puppala et al. states how "an estimated 20 million Americans are affected with GBD, and >700,000 cholecystectomies are performed every year." (377). The number of people affected and the number of cholecystectomies, surgeries to remove the gallbladder, conducted show how serious GBD can be both health-wise and financially. The major risk factors related to GBD are numerous, including age, obesity, and even certain ethnicities have a higher risk factor. These factors are not the only reasons GBD can occur, but genetics could also plays a role. It's been observed that a defect in a gene could lead to gallstones forming or certain genetic determinants can increase the possibility of GBD manifesting in a person (Puppala et al., 2006).

The theory that certain diseases have genetic determinants is not new, in fact, before a link was discovered between GBD and human genes a study was conducted that determined more than 20 susceptible loci for mice were possible candidate genes connected to the formation of gallstones (Katsika et al., 2010). These genes, categorized as Lith genes, gave researchers a point to start working into the actual genetic determinants for GBD. Not only did researchers look into a connection between human genes and GBD, but Katsika et al. went a step further to find a potential connection between siblings, specifically twins. Genetic information is known to be

passed down from parent to offspring and that this information is capable of alterations, whether they be the result of environmental factors or from mutations (Xavier et al,. 2019). The experiment conducted by Katsika et al. attempted to confirm the existence of genotypic allele variants of certain genes found within monozygotic twins and their relation to GBD. Their findings showed that one, the variants they tried were risk factors for GBD and second, that genes are a critical factor for the disease. Not only is knowing which genes are involved important, but it's essential to understand which enzymes they code for are connected to GBD. In the article by Wang et al. the researchers focus their attention to a specific receptor, known to be expressed within the gallbladder, that is coded by one of the Lith genes found in mice. That same gene in mice was found to be connected to the increase occurrence of cholesterol cholelithiasis, formation of gallstones comprised of harden cholesterol, in humans (Wang et al,. 2020). The allele variants of genes and the specific genes themselves are the genetic determinates that can lead to the development of GBD.

Each of these studies Puppala et al. and Katsika et al. based their methods on people who have either had a medical history of having gallstones before or were found to have gallstones during the collection of data itself. In both studies participants were asked to undergo an ultrasound, because of its "high sensitivity" and it's ability to easily detect gallstones. The formation of gallstones is considered the most common form of gallbladder disease, but the way gallstones form can vary depending on the conditions. Iordanidis et al. states that there are four types of gallstones that can be identified "a black pigment, consisting of aragonite and bilirubin; a mixed stone, composed of calcite, oxalates, and phosphates; a cholesterol-rich stone; and a large stone, consisting of uric acid." (301). Wang et al. focuses on the gene that codes for a specific receptor involved in regulating the gallbladder's motility, its contractions and emptying. By understanding how gallstone form researchers are able to observe the genes or proteins are directly involved with GBD and their role in GBD.

Methods

Design

An observational research design will be used through interviews of the Reyes Family by using the internet. Questions regarding personal and medical history will be asked to analyze a potential connection between inheritable traits and gallbladder disease.

Participants

This study will be made up of at least three generations of the Reyes family, from 20 to 98 years of age. Participants will be interviewed and asked questions regarding sex, age, and locations of current and pass residence. Participants will also be asked question regarding whether they ever had a surgery due to gallbladder disease or if they know of a relative who has.

Materials

The study will involve interviews regarding medical and personal history. Information obtained from the interviews will serve as evidence towards the thesis statement. Secondary sources will provide support in answering the research question.

Procedure

This interview will be done over the internet, via zoom or skype. As the interviewer I will inform my family members that any information I might inquire about they would voluntarily give and if they wish to not respond to any of the personal or medical history questions I ask it's understandable. Once the interview is concluded I will have them sign my notes to prove that everything heard and written has been recorded correctly. Afterward the information would be used to produce two figures, both visible within the appendix, a pedigree chart and a list of susceptible genes and their purpose.

Expected Conclusions

By analyzing the constructed pedigree and sources, collected for the paper, a conclusion can be created of gallbladder disease potentially being a disease that runs within my own family. Both environmental and genetic determinates are critical in the manifestation of gallbladder disease and certain risks are increased due to susceptible genes.

To improve efficiency of this experiment a larger study group is required. If possible a genetic test should be conducted to find and identify any genes that both appear in several family members but are also connected to GBD.

Significance

Except for gallbladder cancer, the other forms categorized as gallbladder disease are not considered a fatal disease, yet the main treatment for GBD is the removal of the gallbladder through surgery. The risk factors that can lead to GBD are numerous and it is simply impossible to avoid them all, especially those that are genetically inherited from our parents. However, by understanding how those genetic determinates work and by taking steps to address or avoid the other risk factors, one can lower their chances of obtaining GBD. By observing my family pedigree and by understanding the risk factors of GBD and the genetic determinants of GBD I can predict my own levels of risk for GBD.

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