

## Aortic Aneurysms Explained: Exploring Insights Through ChatGPT

Anjani Mahesh Kumar Cherukuri\*

Guntur Medical College, Guntur, India

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**\*Corresponding author:** Anjani Mahesh Kumar Cherukuri MBBS, Guntur Medical College, Guntur, India

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### ABSTRACT

ChatGPT, a conversational AI launched in 2022, shows promise as a tool for patient education in healthcare. This study evaluates its effectiveness in explaining aortic aneurysms through simulated patient queries. ChatGPT provided accurate, accessible responses on types, causes, symptoms, diagnosis, and treatment options. While its clarity and ease of use enhance patient understanding, limitations such as potential inaccuracies, lack of clinical judgment, and privacy concerns remain. Used responsibly, ChatGPT can supplement clinical care by improving patient knowledge and supporting informed decision-making.

Keywords: ChatGPT; Healthcare; Medicine

### INTRODUCTION

Since its launch in November 2022, ChatGPT has quickly gained widespread attention. Standing for "Chat Generative Pre-Trained Transformer," ChatGPT is a sophisticated language model that integrates artificial intelligence (AI) and natural language processing. It is capable of understanding conversations and generating responses that resemble human-like, high-quality text.

Given its vast repository of data, it has found diverse applications across various fields. While its use in medicine and medical education is still evolving, it holds great potential as an educational tool due to its capacity to present complex information in an accessible manner.<sup>[1]</sup>

#### Aortic aneurysms:

An aortic aneurysm is an abnormal widening of a section of the aorta, with the potential for further expansion and rupture. These aneurysms are categorized based on their size, location, shape, and underlying cause. In recent years, the prevalence of aortic aneurysms has risen, driven by factors such as an aging population, increased smoking rates, the advent of screening programs, and improvements in diagnostic techniques.<sup>[2]</sup> Although unruptured aneurysms are often asymptomatic, a rupture can result in severe, sharp pain and lead to shock, and could be life-threatening. The primary focus of treatment is to prevent rupture, and management plans are customized for each patient. These may include lifestyle changes to mitigate risk factors, medical

treatments, and surgical options, either through open surgery or endovascular procedures. Early detection, along with tailored treatment strategies, is critical in minimizing complications and enhancing patient outcomes.

#### Conversation

Question	Response by ChatGPT
<b>What is an Aortic Aneurysm?</b>	<p>An <b>aortic aneurysm</b> is an abnormal enlargement or bulging of the aorta, the large blood vessel that carries oxygen-rich blood from the heart to the rest of the body. The walls of the aorta weaken over time, and the aneurysm can continue to expand. If it becomes too large, it can rupture, which can be life-threatening. Aortic aneurysms typically occur in two areas: the <b>abdominal aorta</b> and the <b>thoracic aorta</b>.</p>
<b>What are the Types of Aortic Aneurysms?</b>	<p>There are two main types of aortic aneurysms:</p> <ul style="list-style-type: none"><li>• <b>Abdominal Aortic Aneurysm (AAA):</b> Occurs in the lower part of the aorta, in the abdomen. This is the most common type, especially among older adults, smokers, and people with atherosclerosis.</li><li>• <b>Thoracic Aortic Aneurysm (TAA):</b> Occurs in the upper part of the aorta, in the chest. This type is less common but can be equally dangerous. It may be linked to high blood pressure, connective tissue disorders, or heart disease.</li></ul> <p>In rare cases, there are also <b>thoracoabdominal aneurysms</b>, which involve both the chest and abdominal aorta.</p>
<b>What are the Causes of Aortic Aneurysm?</b>	<p>Several factors can contribute to the development of an aortic aneurysm, including:</p> <ul style="list-style-type: none"><li>• <b>Atherosclerosis:</b> The buildup of plaque in the arteries can weaken the walls of the aorta.</li><li>• <b>High blood pressure (hypertension):</b> Increased pressure can put strain on the aorta, leading to weakening.</li><li>• <b>Genetic conditions:</b> Disorders like <b>Marfan syndrome</b>, <b>Ehlers-Danlos syndrome</b>, or <b>Loeys-Dietz syndrome</b> can cause connective tissue weaknesses that increase the risk of aneurysms.</li><li>• <b>Injury or trauma:</b> Physical trauma, like car accidents, can damage the aorta and lead to aneurysm</li></ul>

	<p>formation.</p> <ul style="list-style-type: none"> <li>• <b>Infections or inflammation:</b> Conditions like <b>syphilis</b> or <b>vasculitis</b> can cause inflammation in the aorta.</li> <li>• <b>Smoking:</b> Smoking accelerates the process of atherosclerosis and damages the aorta's walls.</li> </ul>
<p><b>What are the Risk Factors for Developing an Aortic Aneurysm?</b></p>	<p>Key risk factors include:</p> <ul style="list-style-type: none"> <li>• <b>Age:</b> The risk increases as you get older, especially over 65 years.</li> <li>• <b>Sex:</b> Men are more likely to develop aortic aneurysms than women.</li> <li>• <b>Smoking:</b> Smoking is a major risk factor and significantly increases the likelihood of aneurysm formation.</li> <li>• <b>High blood pressure (hypertension):</b> Uncontrolled blood pressure is a major contributing factor.</li> <li>• <b>Family history:</b> A family history of aneurysms or other vascular diseases increases your risk.</li> <li>• <b>Genetic conditions:</b> Connective tissue disorders, like <b>Marfan syndrome</b>, increase the risk.</li> <li>• <b>Chronic lung diseases:</b> Conditions like <b>COPD</b> (chronic obstructive pulmonary disease) increase the risk of aneurysm formation.</li> </ul>
<p><b>What are the Symptoms of Aortic Aneurysm?</b></p>	<p>Aortic aneurysms often develop without symptoms, but some common signs may include:</p> <ul style="list-style-type: none"> <li>• <b>Abdominal Aortic Aneurysm (AAA):</b> <ul style="list-style-type: none"> <li>○ A pulsating feeling near the belly button</li> <li>○ Deep, constant abdominal or back pain</li> <li>○ Sudden, severe pain in the abdomen or back if the aneurysm is about to rupture</li> </ul> </li> <li>• <b>Thoracic Aortic Aneurysm (TAA):</b> <ul style="list-style-type: none"> <li>○ Chest or upper back pain</li> <li>○ Difficulty breathing or swallowing</li> <li>○ Hoarseness</li> <li>○ Coughing or shortness of breath</li> </ul> </li> </ul> <p>However, many people with aortic aneurysms don't</p>

	<p>experience symptoms until it becomes large or ruptures.</p>
<b>What are the Warning Signs of Aortic Aneurysm?</b>	<p>Warning signs, particularly in the case of a <b>rupturing or dissection</b> of an aneurysm, can include:</p> <ul style="list-style-type: none"><li>• <b>Sudden, severe pain</b> in the abdomen, chest, or back</li><li>• <b>Lightheadedness or dizziness</b>, potentially leading to fainting</li><li>• <b>Rapid heart rate</b> or low blood pressure</li><li>• <b>Sweating</b>, nausea, or vomiting</li><li>• <b>Loss of consciousness</b> in extreme cases of rupture or dissection</li></ul> <p>If you experience these symptoms, seek emergency medical attention immediately.</p>
<b>How do you diagnose an aortic aneurysm ?</b>	<p>Diagnosing an aortic aneurysm typically involves a combination of clinical evaluation, imaging tests, and sometimes family history or genetic factors. Here's an overview of the diagnostic process:</p> <p><b>1. Clinical Evaluation:</b></p> <ul style="list-style-type: none"><li>• <b>Medical History:</b> The doctor will inquire about risk factors such as family history, high blood pressure, smoking, cholesterol levels, connective tissue disorders, or previous cardiovascular issues.</li><li>• <b>Physical Exam:</b> During a physical exam, a doctor might feel for a pulsating mass in the abdomen (abdominal aortic aneurysm) or listen for abnormal sounds (bruits) over the aorta with a stethoscope.</li></ul> <p><b>2. Imaging Tests:</b></p> <ul style="list-style-type: none"><li>• <b>Ultrasound:</b> This is often the first-line test to detect abdominal aortic aneurysms. It's non-invasive, uses sound waves to create an image of the aorta, and helps determine the size and shape of the aneurysm.</li><li>• <b>CT Scan (Computed Tomography):</b> A CT scan provides detailed cross-sectional images of the aorta, helping to assess the size, shape, and location of the aneurysm. This is often used to monitor an aneurysm over time or before surgery.</li><li>• <b>MRI (Magnetic Resonance Imaging):</b> MRI can offer detailed images of the aorta and is useful for identifying the extent of the aneurysm and assessing the condition of the aortic wall.</li><li>• <b>Chest X-ray:</b> A chest X-ray might show an enlarged aorta in the case of a thoracic aortic aneurysm, but it is not as detailed for diagnosing aneurysms as other</li></ul>

	<p>imaging techniques.</p> <p><b>3. Other Tests:</b></p> <ul style="list-style-type: none"><li>• <b>Angiography:</b> In some cases, especially if the aneurysm is complex or requires surgical planning, angiography (injection of dye into the bloodstream followed by imaging) may be used to get detailed views of the blood vessels.</li><li>• <b>Genetic Testing:</b> If there is a family history of aortic aneurysms or connective tissue disorders, genetic testing might be considered.</li></ul> <p><b>4. Monitoring:</b></p> <ul style="list-style-type: none"><li>• For small aneurysms (generally under 5 cm), regular monitoring with ultrasound or CT scans may be recommended to check for growth.</li></ul>
<b>What is the Treatment Available for Aortic Aneurysm?</b>	<p>Treatment depends on the size, location, and growth rate of the aneurysm:</p> <ul style="list-style-type: none"><li>• <b>Small aneurysms</b> (less than 5.5 cm in diameter) may just be monitored with regular imaging, along with controlling risk factors like high blood pressure and cholesterol.</li><li>• <b>Larger aneurysms</b> or those that are rapidly expanding require surgical intervention:<ul style="list-style-type: none"><li>◦ <b>Open surgery:</b> The damaged portion of the aorta is removed and replaced with a synthetic graft.</li><li>◦ <b>Endovascular repair (EVAR):</b> A less invasive procedure where a stent graft is inserted through the groin and placed inside the aorta to repair the aneurysm.</li></ul></li></ul>
<b>What are the Differences Between Open vs Endovascular Surgery for Aortic Aneurysm?</b>	<ul style="list-style-type: none"><li>• <b>Open Surgery:</b><ul style="list-style-type: none"><li>◦ Involves a large incision in the abdomen or chest.</li><li>◦ The damaged section of the aorta is replaced with a synthetic graft.</li><li>◦ Recovery time is longer, and there is a higher risk of complications like infection or bleeding.</li><li>◦ Typically recommended for larger, more complex aneurysms.</li></ul></li><li>• <b>Endovascular Surgery (EVAR):</b><ul style="list-style-type: none"><li>◦ A less invasive procedure that involves</li></ul></li></ul>

	<p>inserting a stent graft through a catheter (usually via the groin).</p> <ul style="list-style-type: none"><li>○ Shorter recovery time and lower risk of complications compared to open surgery.</li><li>○ Preferred for patients who are at high risk for open surgery or have smaller, less complicated aneurysms.</li></ul>
<b>What are the Complications of Having Aortic Aneurysm Surgery?</b>	<p>Potential complications can include:</p> <ul style="list-style-type: none"><li>• <b>Infection</b> at the surgical site.</li><li>• <b>Excessive bleeding or blood clots.</b></li><li>• <b>Organ damage</b> (e.g., kidney or bowel damage).</li><li>• <b>Stroke or heart attack</b> due to the stress of surgery.</li><li>• <b>Aortic dissection</b> or rupture if the surgery doesn't fully repair the aorta.</li><li>• <b>Endoleaks</b> in endovascular repair (persistent blood flow into the aneurysm sac).</li><li>• <b>Nerve injury or paralysis</b>, especially in cases involving the thoracic aorta.</li></ul>
<b>What are the Risks of Not Opting for Surgery?</b>	<p>Choosing not to have surgery for aortic aneurysms can be dangerous, as it increases the risk of:</p> <ul style="list-style-type: none"><li>• <b>Rupture:</b> If the aneurysm grows too large, it can burst, leading to life-threatening internal bleeding.</li><li>• <b>Aortic dissection:</b> The aorta may tear, causing severe complications, including stroke or death.</li><li>• <b>Death:</b> The most significant risk is sudden death from rupture or dissection, especially if the aneurysm is large or symptomatic.</li></ul> <p>For larger aneurysms or those that are expanding rapidly, surgery is usually recommended to reduce these risks.</p>
<b>What are the Chances of Recurrence of Aortic Aneurysm After Surgery?</b>	<p>Recurrence of aortic aneurysms can occur, particularly after <b>endovascular repair (EVAR)</b> due to:</p> <ul style="list-style-type: none"><li>• <b>Endoleaks:</b> A type of recurrence where blood continues to flow into the aneurysm sac, potentially causing the aneurysm to grow again.</li><li>• <b>Graft migration or fracture</b> can also cause recurrence.</li></ul>

	<p>After <b>open surgery</b>, recurrence is less common, but aneurysms can still develop in other parts of the aorta or even in the repaired area over time, especially if risk factors like high blood pressure or smoking are not controlled.</p>
<b>What are the Ways to Prevent Developing an Aortic Aneurysm?</b>	<p>Preventive measures to reduce the risk of developing an aortic aneurysm include:</p> <ul style="list-style-type: none"><li>• <b>Control blood pressure:</b> Regularly monitor and manage blood pressure through medication, diet, and exercise.</li><li>• <b>Quit smoking:</b> Smoking is one of the strongest risk factors for aortic aneurysms.</li><li>• <b>Healthy diet:</b> A heart-healthy diet rich in fruits, vegetables, and whole grains can help reduce the risk of atherosclerosis, which weakens the aorta.</li><li>• <b>Exercise regularly:</b> Staying physically active helps maintain healthy blood pressure and cardiovascular health.</li><li>• <b>Monitor cholesterol levels:</b> Control cholesterol through diet, exercise, and medications if necessary.</li><li>• <b>Genetic screening:</b> If you have a family history of aneurysms or genetic conditions like <b>Marfan syndrome</b>, consider screening.</li></ul>

## DISCUSSION

ChatGPT provides significant value in patient education by offering continuous access to personalized, simplified information, which can help reduce the burden on healthcare professionals and enhance patient comprehension. However, it is not without limitations, including a lack of empathy, the potential for inaccuracies, and the risk of patients becoming overly reliant on it rather than seeking professional care. Additionally, concerns regarding patient privacy and the inability to conduct physical examinations or complex medical assessments highlight the need for stringent oversight.

Despite these limitations, ChatGPT has demonstrated a robust understanding of medical content, effectively communicating essential information in an accessible manner, which is particularly beneficial for patients with limited medical knowledge. This makes it a valuable resource for educating patients, particularly in complex conditions such as aortic aneurysms. While ongoing monitoring is necessary to prevent misinterpretation, ChatGPT's ability to provide clear, supportive, and empathetic responses is crucial for promoting patient understanding. In an era of widespread misinformation, ensuring that patients receive accurate, comprehensible information is critical to empowering them to make informed decisions and seek timely medical intervention.

Ultimately, while ChatGPT can be an effective supplementary tool, it should serve as a complement to, rather than a replacement for, human interaction and clinical judgment, facilitating patient engagement in their care and improving health outcomes.

### **Patient Awareness and Physician-Guided Education**

Awareness of risks and treatment options among patients diagnosed with or under surveillance for aortic aneurysms remains limited.<sup>[3]</sup> The incidence of abdominal aortic aneurysm (AAA) has risen with expanded screening and imaging, and most patients now enter long-term surveillance rather than immediate repair. Studies suggest that this period of monitoring can heighten anxiety and negatively affect quality of life.<sup>[2]</sup> Despite physicians being the primary and most trusted source of information, relied upon by nearly 85% of patients, knowledge gaps persist. Many patients correctly answer only about half of disease-related questions, and fewer than 5% demonstrate a strong understanding of their condition.<sup>[3]</sup>

Structured, physician-provided patient guides can help address these deficiencies.<sup>[1]</sup> Educational interventions tailored to individual needs, especially for patients at higher risk of limited understanding, can improve disease knowledge, reduce anxiety, and support informed decision-making. Integrating such standardized, evidence-based materials, delivered in person or via hybrid digital formats, may enhance patient engagement and complement AI-based tools like ChatGPT in promoting better health literacy and outcomes.

### **The Role of AI Tools and the Need for Physician Oversight**

While chatbots such as ChatGPT are increasingly accessible and have demonstrated high accuracy and strong alignment with clinical guidelines across various medical disciplines, their responses often require advanced reading comprehension. A recent systematic review and meta-analysis reported that chatbot-generated educational content was largely appropriate and guideline-concordant, yet written at a college reading level, significantly higher than that of the average patient.<sup>[4]</sup> Without appropriate context or physician oversight, such information could inadvertently heighten anxiety, particularly for patients with serious conditions like aortic aneurysms.<sup>[5]</sup> Unmoderated exposure to technical or risk-heavy content may lead to unnecessary worry or misinterpretation.

Therefore, while chatbots hold promise as supplementary educational tools, their optimal use likely lies in physician-directed, condition-specific applications. Structured guides supervised by healthcare providers can combine the accessibility of AI with the reassurance and accuracy of clinical judgment, minimizing misinformation and improving patient confidence.

Ultimately, while ChatGPT can be an effective supplementary tool, it should serve as a complement to, rather than a replacement for, human interaction and clinical judgment, facilitating patient engagement in their care and improving health outcomes.

## **CONCLUSION**

In conclusion, ChatGPT demonstrates significant potential as a valuable tool for patient education, offering clear and compassionate explanations of complex medical conditions such as aortic aneurysms. While vigilance is required to mitigate potential inaccuracies, the technology can substantially enhance patient understanding,

promote informed decision-making, and facilitate timely medical intervention. To optimize its effectiveness, it is essential to ensure that ChatGPT delivers accurate, evidence-based information, tailored to the specific needs of each patient.

Furthermore, the use of clear, accessible language, combined with an empathetic tone, can foster a supportive educational environment. Ensuring compliance with privacy regulations such as HIPAA, and enabling seamless referrals to healthcare professionals, will further strengthen its utility. As artificial intelligence continues to advance within the healthcare sector, its role in improving communication, empowering patients with knowledge, and supporting proactive health management will be instrumental in enhancing the quality of patient care.

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