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Artificial Intelligence Enhances Heart Surgeries

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Abstract

BACKGROUND: Heart surgery is used to treat serious heart diseases.

METHODS: This is a perspective article on heart surgeries, by reviewing the papers on Europe percutaneous mitral commissurotomy (PMC) concerning heart surgeries, as Europe PMC is a trusted academic engine. The author included all papers on the subject, but papers from the last 5 years are the favorite for references, without exclusion from review.

RESULTS: There are 192,265 case reports (28.5%), 143,267 clinical trials (21.2%), 303,690 reviews (45%), and 34,323 miscellaneous (5%).

CONCLUSIONS: Artificial intelligence is the future of advances in heart surgeries as they are highly distributed in the world.

Introduction

Heart surgery, also known as cardiovascular surgery, is a medical procedure used to treat conditions or diseases affecting the heart and blood vessels. The surgery may involve repairing or replacing damaged or blocked arteries, repairing or replacing heart valves, removing plaque from arteries, or correcting congenital heart defects. Heart surgery can be performed using traditional open-heart surgery or minimally invasive techniques using small incisions and specialized instruments. It is typically performed by a team of cardiovascular surgeons, anesthesiologists, and other medical professionals trained in the field of cardiac surgery [1].

Heart surgery is important because it is often used to save or improve the lives of people with serious heart conditions or diseases. Some of the most common reasons for heart surgery include:

Coronary artery disease: A condition that occurs when the arteries that supply blood to the heart become blocked or narrowed due to the buildup of plaque. Heart surgery can remove the plaque and restore blood flow to the heart.

Heart valve disease: A condition in which the valves in the heart become damaged or diseased, making it difficult for blood to flow properly. Heart surgery can repair or replace the damaged valve to improve blood flow and prevent further heart damage.

Congenital heart defects: A condition in which the heart develops abnormally before birth. Heart surgery can repair or correct these defects, allowing the heart to function properly and prevent serious complications later in life.

Aortic aneurysm: A condition in which the wall of the aorta, the largest artery in the body, weakens, and bulges. Heart surgery can repair or replace the weakened section of the aorta to prevent a life-threatening rupture [2].

There are several types of heart surgery, which can be categorized by their purpose or the specific procedure they involve.

1. Coronary artery bypass grafting (CABG): This surgery is used to bypass blockages in the coronary arteries, which supply blood to the heart muscle. It involves using a blood vessel from another part of the body to create a “bypass” around the blocked or narrowed artery
2. Open-heart surgery: This is a general term that refers to any surgery that involves opening the chest to access the heart. This can range from relatively minor procedures (such as inserting a pacemaker) to extensive surgeries (such as valve replacement or CABG)
3. Valve repair or replacement: Heart valves ensure that blood flows through the heart in the right direction. If a valve is damaged or not functioning properly, it may need to be repaired

or replaced. This can involve either repairing the valve with sutures or replacing it with an artificial valve

4. Aortic aneurysm repair: An aneurysm is a bulge in the wall of the aorta (the main artery that carries blood from the heart). If an aneurysm is at risk of rupturing, surgery may be needed to repair or replace the affected section of the artery
5. Heart transplant: In some cases, a patient's heart may be so damaged that a transplant is required. This involves removing the patient's heart and replacing it with a healthy heart from a donor. The specific type of surgery used will depend on the patient's condition, the severity of their symptoms, and their overall health and medical history [3].

There are several benefits of heart surgery, depending on the patient's condition and the type of surgery performed. Some of the benefits of heart surgery include:

1. Improved quality of life: Heart surgery can help relieve symptoms such as chest pain, shortness of breath, and fatigue, allowing patients to enjoy an improved quality of life
2. Reduced risk of heart attack or stroke: By removing blockages in the arteries or repairing heart defects, heart surgery can reduce the risk of heart attack or stroke
3. Improved heart function: Heart surgery can repair or replace damaged valves, improving the heart's ability to pump blood and reducing the risk of heart failure.
4. Increased lifespan: For some patients, heart surgery can increase their lifespan and prevent further heart damage or complications
5. Minimally invasive options: In some cases, heart surgery can be performed using minimally invasive techniques, which can lead to shorter hospital stays, faster recovery times, and less pain and scarring
6. Prevents complications: If left untreated, some heart conditions can lead to serious complications, such as heart failure, pulmonary embolism, or stroke. Heart surgery can help prevent these complications from occurring [4].

Methods

This is a perspective article on heart surgeries, by reviewing the papers on Europe PMC concerning heart surgeries, as Europe PMC is a trusted academic engine. The author included all papers on the subject, but papers from the past 5 years are the favorite for references, without exclusion from review.

Results

There are 192,265 case reports (28.5%), 143,267 clinical trials (21.2%), 303,690 reviews (45%), and 34,323 miscellaneous (5%) (Table 1).

Table 1: Distribution of the types of papers on Europe percutaneous mitral commissurotomy concerning heart surgeries. n = 673,545

Case reports	Clinical trials	Reviews	Miscellaneous
192,265 (28.5%)	143,267 (21.2%)	303,690 (45%)	34,323 (5%)

There are 171,731 (25.4%) open heart surgeries, 31,469 (4.6%) minimal invasive heart surgeries, 7,314 (0.1%) robotic heart surgeries, 31,995 (4.6%) laser heart surgeries, and 431,036 (63.9%) miscellaneous (Figure 1).

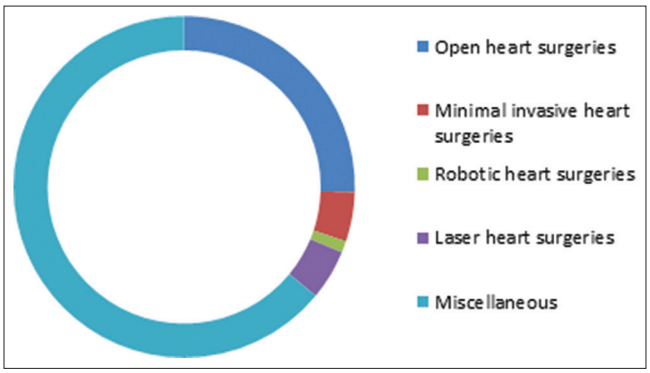


Figure 1: Distribution of the types of papers on Europe percutaneous mitral commissurotomy concerning types of heart surgeries. n = 673,545

Discussion

AI is an acronym for "Artificial Intelligence (AI)," which refers to the development of computer systems that can perform tasks that would normally require human cognitive abilities such as learning, problem-solving, perception, and decision-making. AI uses algorithms and statistical models to analyze large amounts of data and make predictions, allowing machines to perceive complex patterns and make informed decisions based on the information. AI technologies include machine learning, natural language processing, robotics, and computer vision, among others. The ultimate goal of AI is to create intelligent machines that can work autonomously without human intervention, improving human productivity, efficiency, and quality of life [5].

AI has several potential benefits for heart surgery, including:

- Improved diagnostic accuracy: AI can help improve the accuracy of heart disease diagnosis by analyzing large amounts of patient data to identify patterns and predict disease risk
- Enhanced surgical planning: AI can help surgeons plan complex surgeries better using medical imaging to create 3D models of the heart and surrounding organs.

This can help surgeons personalize treatment planning and reduce the risk of complications.

- Smarter decision-making during surgery: During heart surgery, AI can be used to continuously monitor patient data such as blood pressure and heart rate. It can alert the surgical team to any sudden changes, helping the team make better decisions and adjust treatment in real-time
- Post-surgical monitoring: AI can help monitor patients after heart surgery to detect complications early and intervene before they become severe. This can lead to faster recovery times and better outcomes
- Patient-specific treatment plans: AI algorithms can be used to analyze data from individual patients, including medical history, genetics, and lifestyle factors, to develop personalized treatment plans [6].

There are several perspectives on heart surgery, depending on the perspective of the individual or group involved.

i. Patient's perspective: For patients who need heart surgery, it can be a daunting experience. They may feel anxious or scared about the surgery itself, as well as the recovery and potential complications. However, heart surgery can also be life-saving and can improve the quality of life for patients once they have recovered

ii. Surgeon's perspective: From a surgical perspective, heart surgery can be one of the most challenging types of surgeries to perform due to the complexity of the cardiovascular system. Surgeons must have a high degree of skill and training to perform these surgeries safely and effectively. They often work long hours and have a high level of responsibility for their patient's well-being

iii. Medical team's perspective: Heart surgery involves a team of medical professionals beyond just the surgeon. Anesthesiologists, perioperative nurses, and other medical staff are all criticals to the success of the surgery. They work closely together to ensure that the patient is safe and comfortable throughout the surgery and during recovery

iv. Family and caregiver perspectives: For the family and caregivers of patients undergoing heart surgery, there may be a sense of worry or uncertainty about the outcome of the surgery. They may feel responsible for supporting the patient during their recovery and helping them to regain their strength and independence [7].

Conclusion

AI is the future of advances in heart surgeries as they are highly distributed in the world.

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