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Optimising anesthesia support during operations on the abdominal aorta and its branches

Adilet Kusainov [1*]

[1] *Kazakh-Russian Medical University, Almaty, Kazakhstan, https://orcid.org/0000-0003-1163-2452*

Abstract

Background: Pathology of the aorta includes aortic aneurysms, coarctation, dissection, atherosclerotic disease, and aortitis. The only two evidence-based treatment options for abdominal aortic repair are endovascular and open surgery. The anesthetic approach and medications may impact the outcomes of the surgical repair of the abdominal aorta and its branches.

Aim: to evaluate the use of various analgesic regimens and local, regional, or general anesthesia in "optimising" surgical outcomes in patients undergoing surgical repair of the abdominal aorta and its branches.

Methods: In this review, English studies from common databases such as Pubmed/MEDLINE, Google Scholar, Web of Science, Scopus, and the Cochrane Library with the keywords "Abdominal aorta," "operations," "aortic branches," combined with keywords, involving " anesthesia were involved." The end date for this review was November 2022.

Scientific novelty: Recent scientific studies have focused on the use of advanced monitoring technologies such as cerebral oximetry and microdialysis to improve the safety and efficacy of anesthesia management in aortic surgery. These technologies provide more accurate and real-time information about cerebral perfusion and metabolism, allowing the anesthesiologist to identify and manage potential complications such as cerebral ischemia more effectively. Additionally, the use of pharmacological agents such as dexmedetomidine and remifentanil has been shown to reduce the risk of postoperative delirium and cognitive dysfunction, further improving patient outcomes.

Conclusion: Aortic surgery is a complex and high-risk procedure that requires careful management of anesthesia to ensure patient safety and optimal outcomes. With ongoing advances in anesthesia techniques and monitoring technologies, there is reason to be optimistic about the future of aortic surgery and the prospects for improved patient outcomes. The anesthesiologist plays a critical role in this process, working closely with the surgical team to provide safe and effective anesthesia throughout the procedure and ensuring that the patient receives appropriate pain management and other supportive care in the postoperative period

Keywords: aorta, abdominal aorta, anerusm, anesthesia, surgical repair.

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* **Corresponding author**: adilet.68@mail.ru
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Introduction

The abdominal and thoracic parts of the aorta are often separated from one another. As the abdominal aorta connects the diaphragm to the aortic bifurcation, the thoracic aorta divides into the ascending, aortic arch, and descending types [1]. Abdominal aortic disease is more likely in people with particular conditions and genetic factors, such as polycystic kidney disease, Turner's syndrome, bicuspid aortic valve, Ehlers-Danlos syndrome, and Marfan syndrome [2,3]. The caudal half of the body and important abdominal organs depend on the integrity of the abdominal aorta, a significant circulatory structure, to survive and function. The end organs may exhibit either an acute or chronic disease when there is a subtle irregularity in the abdominal aorta and its branches [4–6]. Many disorders can affect the abdominal aorta; some more prevalent ones are atherosclerosis, dissections, aneurysms, and aorto-arteritis.

An abdominal aortic repair is a primary surgical treatment used to treat an aortic condition [7]. While the endovascular placement of an aortic stent graft is graded as an intermediate-risk intervention with a cardiac risk between 1% and 5%, the open aortic repair was classified as a high-risk intervention (defined as carrying a risk of cardiovascular death or myocardial infarction of 5% or more within 30 days) [8–10]. The most prevalent complications associated with surgical repair of the abdominal aorta are bleeding, ischemic colitis, acute renal failure, thrombosis of Vein Grafts, distal embolisation, pseudoaneurysm formation, infection, neurologic deficits, aortocaval and aorto-enteric fistulae, sexual dysfunction, ureteral obstruction, perigraft seroma and chylous ascites [11,12]. So the surgical repair of abdominal aorta has so many risks and needs expierenced surgeons, radiologists, and anasthesiologists. One of the key challenges in aortic surgery is maintaining hemodynamic stability during the procedure. This requires close monitoring of blood pressure, heart rate, and cardiac output and careful management of fluid and electrolyte balance. The anesthetic support and the type of anesthesia are important in reducing these risk factors and decreasing mortality and morbidity rates.

The main objectives of intraoperative anesthetic management are: (a) hemodynamic stability; preservation of perfusion to vital organs, such as the brain, heart, kidney, spinal cord, and splanchnic vessels; (b) avoidance of an imbalance in the oxygen supply and demand of the myocardium; (c) maintenance of intravascular volume; and (d) normothermia. Excellent surgical conditions are provided by general anesthesia combined with muscular relaxation and artificial ventilation [13,14]. All forms of spinal anesthesia are suitable for the endovascular placement of an aortic stent graft, including epidural, combination spinal and epidural, and continuous spinal.

Research focus

This review focuses on assessing the utilisation of general anesthesia and different regimens of analgesics to reduce the complications associated with the surgical repair of the abdominal aorta and its branches.

Research problem

Cardiovascular and pulmonary comorbidities are frequently present in patients undergoing operative repair of the abdominal aorta and its branches. It can enhance the severity and frequency of the complications above. Using anesthesia and analgesia as effectively as possible is crucial in the probability of complications decrease.

Research questions

1. What are the indications of surgical renovation of the abdominal aorta and its branches?
2. What are the complications of surgical reparation of the abdominal aorta and its branches?
3. What is the best way to use anesthesia to repair the abdominal aorta and its branches surgically?

Research aim

This review aims to evaluate the use of various analgesic regimens and local, regional, or general anesthesia in "optimising" surgical outcomes in patients undergoing surgical reparation of the abdominal aorta and its branches.

Research Methodology

General background

Patients with indications for abdominal aortic aneurysm (AAA) repair but unfavorable anatomy for endovascular aortic repair are treated with open aortic surgery. Even when the management of bleeding is initially achieved by an endovascular procedure, open aortic surgery is still required to manage aortic thrombosis or repair an aortic rupture for any reason (such as a traumatic rupture, ruptured AAA, or ruptured aortic dissection). The site of the cross-clamp application, the intravascular volume, the anesthetic approach and medications used, the surgical

pathology, the preoperative myocardial function, and coronary circulation will all impact the hemodynamic effects of aortic cross-clamping. An abrupt aortic cross-clamping is expected to result in decreased velocity and shortening of myocardial muscle fibers and increased afterload, reduced preload, and lowered impedance to ventricular ejection.

No anesthetic method or technique is suitable for all patients undergoing aortic vascular surgery. There is much debate about using inhalational versus opioid anesthesia, regional with general anesthesia, and isoflurane in patients with coronary artery disease. The anesthetic substances and procedures selected should guarantee a smooth induction of anesthesia, a positive cardiovascular dose-response relationship that protects the sensitive myocardial oxygen supply/demand balance, appropriate muscular relaxation with intra-operative analgesia, and amnesia. Nitrous oxide/oxygen with the incremental volatile agent or opiate supplementation; opiate-oxygen or an opiate-oxygen-volatile agent combination with or without regional anesthesia are the anesthetic technique options.

In our review, English studies from common databases such as Pubmed/MEDLINE, Google Scholar, Web of Science, Scopus, and the Cochrane Library with the keywords were involved "Abdominal aorta," "operations," "aortic branches," combined with keywords, involving " anesthesia." The end date for this review is November 2022. The studies using each set of keyword combinations were then pooled to create an impartial collection of publications. Studies and/or articles that weren't subjected to peer review, as well as proposals, procedures, letters, and opinions, were eliminated. The references include publications that were chosen because they are related to our topic. This paper focused on optimising anesthesia support during operations on the abdominal aorta and its branches.

Statistical analysis

In this review, the results of previous trials and retrospective studies that tried to evaluate the use of various analgesic regimens and local, regional, or general anesthesia in "optimising" surgical outcomes in patients undergoing surgical repair of the abdominal aorta and its branches were gathered and compared. So, any statistical analysis methods were not used, nonetheless conclusions were made by comparing these results.

Research Results | Literature review

The result of the search using the given search strategy was 6109 articles. These articles were screened to choose the articles related to the topic. A full-text screening of 347 articles after excluding the remaining article by title and abstract screening was accomplished. Finally, 52 articles were used in order to gather information about the topic and write this review (Figure 1).

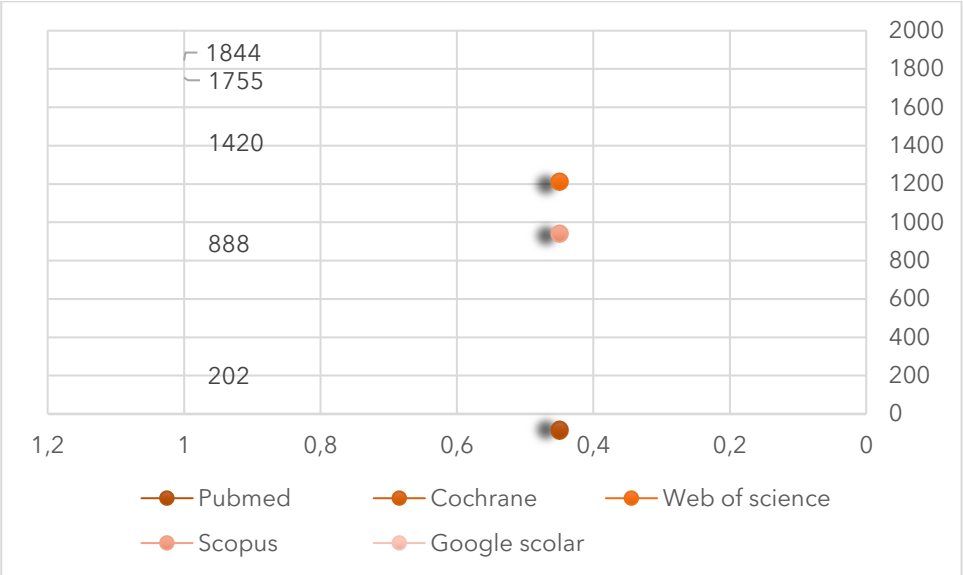

Figure 1. **Research results**

Abdominal aorta

The main artery in a person's body is the aorta. The ascending aorta is formed by a blood vessel that emerges from the heart's left ventricle. In order to create the aortic arch and the thoracic aorta, it loops inferiorly and passes through the thorax [15]. The abdominal aorta, which is appropriately named, finally divides into the common iliac arteries in the lower abdomen after crossing the diaphragm into the abdomen. The arterial branches that are responsible for delivering oxygen-rich blood to all of the body's tissues are created along the route by the aorta. All of the body's arteries emerge from the aorta, which is the primary source of oxygenated blood before they proceed distally to their target tissues [16,17]. Major arterial branches from the aorta include the left and right coronary arteries, left common carotid, brachiocephalic, celiac trunk, left subclavian, left and right renal, superior mesenteric, inferior mesenteric, gonadal, right and left common iliac arteries, and median sacral [18] Figure 2.

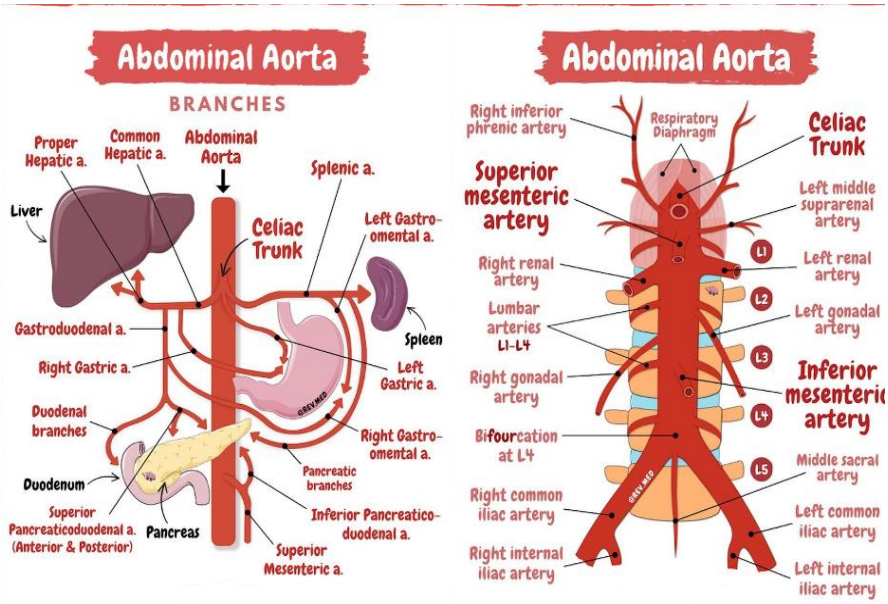

Figure 2. **Anatomy of the abdominal aorta and its branches [25].**

The inferior and superior mesenteric arteries supply the hindgut and midgut, respectively, while the celiac trunk mostly nourishes the foregut. The inferior phrenic, middle gonadal, suprarenal, median sacral, and lumbar arteries are a few other prominent abdominal aorta branches [19]. It's vital to remember that the inferior suprarenal arteries come from the renal arteries, whereas the superior suprarenal arteries come from the inferior phrenic arteries. The vasa vasorum, a system of small blood vessels, supplies the aorta [20]. Because of the increased oxidation and inflammation rates in the aortic walls caused by the decrease in vasa vasorum, the infrarenal abdominal aorta is more likely to develop an aneurysm. After vascular supply comes lymphatic drainage [21]. Most of the abdomen and lower extremities send lymphatics to the cisterna chyli, which is directly below the diaphragm's aortic hiatus. The thoracic duct then allows lymph to advance superiorly. The aorta is a very sensitive blood vessel following trauma or other sorts of medical problems because it receives so much blood. The aorta can lose most of the body's blood volume in a few minutes if it is separated or burst, resulting in death. The aorta, the largest blood vessel in the body, serves as a conduit for all blood leaving the heart that isn't headed directly for the heart. Blood is carried via the abdominal aorta to the legs and feet in addition to the organs in the abdominal cavity. The aorta also aids in blood pressure regulation by expanding and contracting as required. The autonomic nervous system's components are principally responsible for innervating the aorta. The parasympathetic and sympathetic nerves closely follow the aorta descent into the abdomen. These nerves group to form plexuses like the celiac, inferior, and superior mesenteric [22]. Vasoconstriction results from the activation of alpha-1 receptors in response to decreased blood pressure. Vasodilation results from the activation of beta-2 receptors. The tunica intima, tunica media, and tunica adventitia are the three layers that make up the wall of the aorta. The internal elastic lamina, which encircles the tunica intima's innermost layer, is lined by a single layer of endothelial cells [23]. The tunica media, which is the middle layer, comprises fibroblasts, collagen, elastin, and smooth muscle cells. These elements use signals from the autonomic nervous system to regulate vasoconstriction and vasodilation [24]. Tensile strength and resistance to the pulsatile character of the circulation are provided by elastin fibers found in the media of the aorta. The outer part of the adventitia is a thin layer of fibroblasts, vasa vasorum, and connective tissue.

Physiological variants

Medical professionals, especially radiologic and surgical professionals, must be aware of the anatomic diversity of the aorta and its branches. To help with care, the doctor should be able to identify the numerous physiological aorta variances on imaging and correlate them with clinical symptoms [26]. Although magnetic resonance imaging (MRI) is typically regarded as the optimum method for imaging the aortic arch and its arterial branching pattern, anomalies are frequently detectable on computed tomography (CT), particularly CT angiography. Right-sided cardiac apex, also known as dextrocardia, is a condition [27]. In a solitary case of dextrocardia of embryonic arrest, the heart is simply positioned more to the right than is normal. The physiologic variation of the aortic arch that is most frequently found is a bovine arch [28]. A common origin between the left common carotid artery and the brachiocephalic artery causes it. When the right subclavian artery emerges distal to the left subclavian artery and hooks back to reach the right side, it forms an aberrant right subclavian artery known as arteria lusoria [29]. Innominate artery compression syndrome happens when the brachiocephalic trunk (innominate artery) is positioned anterior to the trachea and further to the left than usual, compressing the artery. Up to 45% to 65% of patients undergoing vascular ring repair have a double aortic arch (DAA) [30]. There are numerous subtypes, but all of them frequently cause compression because the ascending aorta divides into two vessels that pass on either side of the esophagus and trachea.

Diseases of the abdominal aorta

There are several diseases of the aorta that may require surgery, including:

Aortic aneurysm:

A bulge or swelling in the wall of the aorta that can rupture and cause life-threatening bleeding. Aortic aneurysm is a condition where the aorta, the largest artery in the body, becomes enlarged and weakened. This can lead to a potentially life-threatening rupture if left untreated. There are two main types of aortic aneurysms: abdominal aortic aneurysms (AAA) and thoracic aortic aneurysms (TAA) [31]. Abdominal aortic aneurysms occur in the lower part of the aorta, in the abdomen. They are more common in men over the age of 65 and in people who smoke or have high blood pressure. Thoracic aortic aneurysms occur in the upper part of the aorta, in the chest. They are less common than AAA but can be more dangerous because they are closer to the heart and can affect the blood supply to vital organs [32]. Symptoms of aortic aneurysm may not be present until the aneurysm has grown large enough to cause problems. Symptoms can include chest or back pain, shortness of breath, coughing, hoarseness, difficulty swallowing, and a pulsing sensation in the abdomen. If you experience any of these symptoms, it is important to seek medical attention immediately. The most common symptom of aortic aneurysm is a pulsating sensation in the abdomen or chest. This sensation may be accompanied by pain or discomfort in the affected area. In some cases, the pain may radiate to other parts of the body, such as the back or legs. The pain may be severe and sudden, or it may be dull and persistent. Other symptoms of aortic aneurysm may include: Swelling: Aortic aneurysm can cause swelling in the legs or feet. And Rapid heartbeat: The heart may beat faster than normal in response to the increased workload caused by the aneurysm.

The most common method of repairing an aortic aneurysm is through surgery. The type of used surgery depends on the location and size of the aneurysm [33]. For AAA, the most common surgical procedure is called an endovascular repair. This involves inserting a stent graft, a small metal mesh tube, into the aorta through a small incision in the groin. The stent graft is then guided up to the aneurysm and expanded, creating a new path for blood flow and relieving pressure on the weakened aortic wall. Endovascular repair has several advantages over open surgery such as shorter hospital stays, less pain, and faster recovery times. However, not all patients are suitable candidates for endovascular repair and the decision to undergo this procedure should be made in consultation with a vascular surgeon. For TAA, open surgery is often required. This involves making a large incision in the chest or abdomen to access the aneurysm. The weakened section of the aorta is then replaced with a synthetic graft. This procedure is more invasive than endovascular repair and requires a longer recovery time, but it may be necessary for larger or more complex aneurysms [34]. In some cases, aortic aneurysms may be monitored without surgery if they are small and not causing symptoms. This involves regular imaging tests to track the size and growth of the aneurysm. Lifestyle changes such as quitting smoking, managing blood pressure, and maintaining a healthy weight can also help slow the growth of an aneurysm and reduce the risk of rupture.

Both open surgery and endovascular repair have their advantages and disadvantages. Open surgery has been used for many years and has proven to be effective in managing aortic aneurysms. However, it is more invasive than endovascular repair and requires longer hospital stays and recovery times. The choice between open surgery and endovascular repair depends on several factors including age, overall health status, anatomy of the aneurysm, location of the aneurysm, and the patient's preference. A team of specialists including vascular surgeons, cardiologists, and radiologists will evaluate each patient's case and determine the best course of treatment. [35].

In conclusion, aortic aneurysm is a serious condition that requires prompt medical attention. Surgery is the most common method of repair, with endovascular repair being the preferred option for AAA and open surgery for TAA. Regular monitoring and lifestyle changes can also help manage the condition and reduce the risk of complications.

Aortic dissection

A tear in the inner layer of the aorta that can lead to a separation of the layers of the aortic wall, causing blood to flow between them and potentially leading to rupture. This can cause the aorta to weaken and potentially rupture, leading to life-threatening complications. Aortic dissection is a medical emergency that requires prompt diagnosis and treatment [36]. Symptoms of aortic dissection can include sudden and severe chest or back pain, shortness of breath, sweating, nausea, vomiting, and fainting. These symptoms can be similar to those of a heart attack, so it is important to seek medical attention immediately if you experience any of them. The treatment of aortic dissection depends on the location and severity of the tear [37]. In some cases, medication may be used to control blood pressure and reduce the risk of further tearing. However, surgery is often required to repair the damaged aorta. The most common surgical procedure for aortic dissection is called aortic root replacement. This involves removing the damaged section of the aorta and replacing it with a synthetic graft. The procedure is performed under general anesthesia and requires a large incision in the chest or abdomen [38]. Recovery time can vary depending on the extent of the surgery and the patient's overall health. Another surgical option for aortic dissection is endovascular repair. This involves inserting a stent graft, a small metal mesh tube, into the aorta through a small incision in the groin. The stent graft is then guided up to the site of the tear and expanded, creating a new path for blood flow and relieving pressure on the weakened aortic wall [39]. Endovascular repair is less invasive than aortic root replacement and may be a better option for patients who are not good candidates for open surgery.

In some cases, a combination of surgical and medical treatment may be used to manage aortic dissection. This can include medication to control blood pressure and reduce the risk of further tearing, as well as surgery to repair the damaged aorta. In conclusion, aortic dissection is a serious medical condition that requires prompt diagnosis and treatment. Surgery is often required in order to repair the damaged aorta, with aortic root replacement and endovascular repair being the most common methods of repair [40]. A combination of surgical and medical treatment may be used to manage the condition and reduce the risk of complications. If you experience symptoms of aortic dissection, seek immediate medical attention.

Coarctation of the aorta

Coarctation of the aorta is a congenital heart defect that occurs when the aorta, the main artery that carries blood from the heart to the rest of the body, is narrowed or constricted. This narrowing can cause high blood pressure and other complications. Coarctation of the aorta is typically diagnosed in childhood, but it can also be diagnosed in adulthood [41]. Symptoms of coarctation of the aorta can include high blood pressure, headaches, chest pain, shortness of breath, and leg cramps. In some cases, there may be no symptoms at all.

The treatment of coarctation of the aorta depends on the severity of the narrowing and the age of the patient. In some cases, medication may be used to control blood pressure and reduce the risk of complications [42]. However, surgery is often required to repair the narrowed section of the aorta. The most common surgical procedure for coarctation of the aorta is called aortic coarctation repair. This involves removing the narrowed section of the aorta and reconnecting the two healthy ends of the artery. The procedure is typically performed under general anesthesia and requires a large incision in the chest or abdomen [43]. Recovery time can vary depending on the extent of the surgery and the patient's overall health.

Another surgical option for coarctation of the aorta is endovascular repair. This involves inserting a stent, a small metal mesh tube, into the narrowed section of the aorta through a small incision in the groin. The stent is then expanded, creating a new path for blood flow and relieving pressure on the narrowed section of the aorta. Endovascular repair is less invasive than aortic coarctation repair and may be a better option for some patients. In some cases, a combination of surgical and medical treatment may be used to manage coarctation of the aorta [44]. This can include medication to control blood pressure and reduce the risk of complications, as well as surgery to repair the narrowed section of the aorta.

In conclusion, coarctation of the aorta is a congenital heart defect that requires prompt diagnosis and treatment [45]. Surgery is often required to repair the narrowed section of the aorta, with aortic coarctation repair and endovascular repair being the most common methods of repair. A combination of surgical and medical treatment may be used to manage the condition and reduce the risk of complications. If you or your child experience symptoms of coarctation of the aorta, seek immediate medical attention.

Anesthetic implications of aortic surgery

Aortic surgery is a complex and high-risk procedure that requires careful management of anesthesia to ensure patient safety and optimal outcomes. In recent years, there have been significant advances in anesthesia techniques and monitoring technologies that have improved the safety and efficacy of aortic surgery.

One of the key challenges in aortic surgery is maintaining hemodynamic stability during the procedure. This requires close monitoring of blood pressure, heart rate, and cardiac output and careful management of fluid and electrolyte balance. In addition, the use of advanced monitoring technologies such as transesophageal echocardiography (TEE) and near-infrared spectroscopy (NIRS) can help to identify and manage potential complications such as hypotension, hypoxia, and cerebral ischemia.

Another important consideration in aortic surgery is the choice of anesthesia technique. General anesthesia is typically used for aortic surgery, but there is ongoing debate about the relative merits of different approaches such as total intravenous anesthesia (TIVA) versus inhalational anesthesia [46,47]. TIVA has been shown to reduce the risk of postoperative delirium and cognitive dysfunction, but may be associated with longer recovery times and higher costs.

In addition to these technical considerations, there are also important ethical and legal issues to consider in aortic surgery. For example, the use of deep hypothermic circulatory arrest (DHCA) may be necessary in some cases to facilitate surgical repair of the aorta, but this technique carries significant risks of neurological injury and other complications [48]. As such, it is important for anesthesiologists to carefully weigh the risks and benefits of DHCA and other advanced techniques in consultation with the surgical team and the patient.

Looking to the future, there is ongoing research into new anesthesia techniques and monitoring technologies that may further improve the safety and efficacy of aortic surgery [49]. For example, the use of pharmacological agents such as dexmedetomidine and remifentanil may help to reduce the risk of postoperative delirium and cognitive dysfunction, while new monitoring technologies such as cerebral oximetry and microdialysis may provide more accurate and real-time information about cerebral perfusion and metabolism.

In conclusion, anesthesia for aortic surgery is a complex and challenging area of practice that requires careful attention to technical, ethical, and legal considerations. With ongoing advances in anesthesia techniques and monitoring technologies, however, there is reason to be optimistic about the future of aortic surgery and the prospects for improved patient outcomes.

Discussion

The anaesthesia management in aortic surgery is complex and requires careful planning and execution. The anaesthesiologist must ensure that the patient is stable throughout the procedure and that the surgical team has adequate access to the aorta. The anaesthesiologist must also monitor the patient's vital signs and adjust the anaesthesia as needed to maintain the patient's comfort and safety. One of the primary concerns during aortic surgery is maintaining adequate blood pressure. The aorta is a large artery that carries a significant amount of blood flow. During surgery, the aorta may be clamped or partially occluded, which can cause a decrease in blood pressure. The anaesthesiologist must carefully monitor the patient's blood pressure and adjust the anaesthesia as needed to maintain adequate perfusion to vital organs. Another concern during aortic surgery is the risk of bleeding. The aorta is a highly vascular structure, and any injury to it can cause significant bleeding. The anaesthesiologist must ensure that the patient's blood clotting factors are normal and may need to administer blood products if bleeding occurs.

In addition to the blood pressure and bleeding monitoring, the anaesthesiologist must also consider other factors during aortic surgery. These may include the patient's medical history, medications, allergies, and any other medical conditions that may affect the patient's response to anaesthesia.

Tanaka et al. [50] investigated the anesthetic management of an abdominal aortic aneurysmorrhaphy in Klippel-Trenaunay-Weber syndrome. They described that the secure anaesthesia care should be provided to a patient with Klippel-Trenaunay-Weber syndrome who experienced an abdominal aortic aneurysm surgery. The aortic cross-clamping may not adequately stop the blood flow in these patients because there are so many aberrant collateral arteries. As a result, significant bleeding following aortic cross-clamping may occur, as in the current instance, necessitating a greater number of spaced blood transfusions than during a typical AAA treatment. Therefore, the management of anaesthesia by anesthesiologists should take this risk into account.

Gelzinis et al. [51] studied the postoperative anesthestic management for AAA. They stated that these patients often get postoperative management in the critical care unit, where the patient may be carefully observed. The treatment of these patients' hypertension by continuing preoperative antihypertensive regimens, which may include beta-blockers, optimising pulmonary function through the use of inhaled bronchodilators, incentive

spirometry, and early extubation, providing analgesia either through regional or parenteral analgesia, and monitoring for bleeding, bowel, and renal dysfunction are all part of their management. Nephrotoxins should be avoided, and enough renal perfusion can be maintained by drinking plenty of fluids and using inotropic medocations during endovascular Aneurysm Repai.

Kothandan et al. [52] studied the anesthetic considerations for endovascular abdominal aortic aneurysm repair (EVAR). They concluded that although EVAR was linked to a reduction in short-term mortality, these benefits did not hold true during intermediate and long-term follow-ups. Major comorbidities are more common in patients receiving EVAR, hence full preoperative evaluation and optimisation should take place in multidisciplinary settings before the treatment. Simple infrarenal EVAR should be distinguished from complicated suprarenal EVAR, which has a greater perioperative risk. The process of getting ready for anaesthesia should be done with the knowledge that significant haemorrhage is a possibility and that switching to an open procedure might happen at any time.

Anaesthesia management in aortic surgery is a critical aspect of the overall patient care. Aortic surgery involves the aorta repair or replacement, which is the largest artery in the human body. The aorta carries oxygenated blood from the heart to the rest of the body. Aortic surgery can be performed for a variety of reasons, including aneurysms, dissections, and traumatic injuries. The anaesthesia management in aortic surgery is complex and requires careful planning and execution. The anaesthesiologist must ensure that the patient is stable throughout the procedure and that the surgical team has adequate access to the aorta. The anaesthesiologist must also monitor the patient's vital signs and adjust the anaesthesia as needed to maintain the patient's comfort and safety. One of the primary concerns during aortic surgery is maintaining adequate blood pressure. The aorta is a large artery that carries a significant amount of blood flow. During surgery, the aorta may be clamped or partially occluded, which can cause a decrease in the blood pressure. The anaesthesiologist must carefully monitor the patient's blood pressure and adjust the anaesthesia as needed to maintain adequate perfusion to vital organs. This is particularly important during the clamping and unclamping of the aorta, which can cause significant changes in the blood pressure. The anesthesiologist must carefully titrate vasoactive drugs such as phenylephrine or nitroglycerin to maintain stable blood pressure levels while avoiding excessive vasoconstriction or vasodilation.

Another important consideration in anesthesia management during aortic surgery is ensuring adequate myocardial protection. The heart may be exposed to ischemia-reperfusion injury during periods of aortic cross-clamping or unclamping. To minimise this risk, the anesthesiologist may administer cardioprotective agents such as adenosine or lidocaine.

Another concern during aortic surgery is the risk of bleeding. The aorta is a highly vascular structure, and any injury to it can cause significant bleeding. The anaesthesiologist must ensure that the patient's blood clotting factors are normal and may need to administer blood products if bleeding occurs. In addition to monitoring blood pressure and bleeding, the anaesthesiologist must also consider other factors during aortic surgery. These may include the patient's medical history, medications, allergies, and any other medical conditions that may affect the patient's response to anaesthesia.

There are several different types of anaesthesia that may be used during aortic surgery. These may include general anaesthesia, regional anaesthesia, or a combination of both. General anaesthesia involves the use of medications in order to induce unconsciousness and prevent pain during the procedure. Regional anaesthesia involves the injection of medication near the nerves that supply the surgical site, which can provide pain relief without the need for general anaesthesia.

Conclusion

1. Aortic surgery is a complex and high-risk procedure that requires careful management of anesthesia to ensure patient safety and optimal outcomes.

2. The anesthesiologist plays a critical role in the management of aortic surgery, working closely with the surgical team to provide safe and effective anesthesia throughout the procedure.

3. Maintaining hemodynamic stability is a key challenge in aortic surgery, requiring close monitoring of blood pressure, heart rate, and cardiac output, as well as careful management of fluid and electrolyte balance.

4. Advanced monitoring technologies such as TEE and NIRS can help to identify and manage potential complications such as hypotension, hypoxia, and cerebral ischemia, allowing the anesthesiologist to intervene quickly and effectively to prevent further harm to the patient.

5. The choice of anesthesia technique is an important consideration in aortic surgery, with TIVA and inhalational anesthesia being the most commonly used approaches.

6. Ethical and legal issues must also be considered in aortic surgery, particularly with regard to the use of advanced techniques such as DHCA, which carries significant risks of neurological injury and other complications.

7. With ongoing advances in anesthesia techniques and monitoring technologies, there is reason to be optimistic about the future of aortic surgery and the prospects for improved patient outcomes. The anesthesiologist plays a critical role in this process, working closely with the surgical team in order to provide safe and effective anesthesia throughout the procedure and ensuring that the patient receives appropriate pain management and other supportive care in the postoperative period.

Declarations

Author contributions

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

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Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

Data supporting the findings and conclusions are available upon request from the corresponding author.

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