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Research progress on the effect of dexmedetomidine on ERAS

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Abstract: *Effective acute pain management has evolved considerably in recent years and is a primary area of focus in attempts to defend against the opioid epidemic.Persistent postsurgical pain (PPP) has an incidence of up to 30–50% and has negative outcome of quality of life and negative burden on individuals, family, and society.The 2016 American Society of Anesthesiologists (ASA) guidelines states that enhanced recovery after surgery (ERAS) forms an integral part of Perioperative Surgical Home (PSH) and is now recommended to use a multimodal opioid-sparing approach for management of postoperative pain[1]. As such,dexmedetomidine is now being used as part of ERAS protocols along with regional nerve blocks and other medications, to create a satisfactory postoperative outcome with reduced opioid consumption in the Post anesthesia care unit (PACU). Recent Findings Dexmedetomidine, a selective alpha2 agonist, possesses analgesic effects and has a different mechanism of action when compared with opioids.When dexmedetomidine is initiated at the end of a procedure, it has a better hemodynamic stability and pain response than ropivacaine.Dexmedetomidine can be used as an adjuvant in epidurals with local anesthetic sparing effects.Its use during nerve blocks results in reduced postoperative pain.Also, local infiltration of IV dexmedetomidine is associated with earlier discharge from PACU.Perioperative use of dexmedetomidine has significantly improved postoperative outcomes when used as part of ERAS protocols.This review addressed the impact of DEX on the postoperative ERAS regimen, ranging from the sedative and analgesic effects and side effects, recovery of gastrointestinal function, respiratory, cardiovascular, neurological, renal, gynecological, pediatric, etc.*

Keywords: *Dexmedetomidine; ERAS; gastrointestinal function recovery*

1. Introduction

The ERAS protocol is a series of perioperative care programs that reduce the delay of complete recovery after major abdominal surgery through the rational use of perioperative anesthetic tics, reduction of surgical stress and maintenance of postoperative physiological function. The implementation of the ERAS pathway has been shown to have a positive impact on reducing postoperative morbidity[2, 3]. Such a protocol is rapidly becoming the standard of care for patients undergoing gastrointestinal surgery by combining two best practice pathways, namely, care care and clinical management, with the goal being to consistently provide optimal care to facilitate early postoperative recovery[4]. The ERAS program integrates a range of perioperative interventions, including surgery and anesthesia, the most important of which is multidisciplinary teamwork, which is key to the success of the ERAS program[5]. There is evidence that many elements of the ERAS program are related to anesthesia care, and therefore, perioperative care guidelines must include recommendations approved by an interdisciplinary team of anesthesiologists and surgeons. It appears that the anesthesiologist is the ideal candidate to guide a multidisciplinary expert team through optimal preoperative assessment, medical optimization, and tailored anesthesia program aiming for rapid recovery and adequate pain relief[5]

This is achieved through pre-and postoperative counseling, enhanced nutritional support, early mobilization, and rational use of anesthetics and painkillers. The importance of the ERAS protocol is evident from reviewing the literature, suggesting that it can improve patient outcomes and provide advanced patient care. Thus, the ERAS programme is uniquely placed in modern medical rehabilitation, which further increases the continued implementation of such protocols across the country. Despite the proven role of ERAS protocols, important issues need to address areas related to postoperative pain management so that physicians can benefit patients after surgery by implementing these protocols.

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Doing so would yield the greatest benefit for patients being treated through the implementation of the ERAS protocol. Greater management of ongoing perioperative pain will translate to reducing patient time to stay in the PACU as well as reduced opioid use[6], To enable patient discharge earlier and improve patient satisfaction.

2. The role of dexmedetomidine

Dexmedetomidine is a multifunctional and highly selective short-acting agonist of α -2 with the effects of sedation, analgesia, anxiolytic, perioperative sympathetic block, and hypnosis. Dexmedetomidine is a highly selective α -2 agonist similar to clonidine for α -2: α -1 receptor specificity; α -2: α -1 specificity 220:1; dexmedetomidine specificity 1620:1. It also has the properties of analgesic, prolonged anesthetic for sympathetic inhibition. Dexmedetomidine has the ideal properties as an ICU sedative, with predictable sedative effect and hemodynamic stability, and easy titration[7].

2.1. Sedation

Dexmedetomidine can induce a unique sedative response called "gratifying sedation" or "cooperative sedation," showing a relaxed transition from sleep to wakefulness, thus enabling patients to cooperate and communicate when stimulated. The sedative properties of DEX are similar to natural sleep. Dexmedetomidine is known to inhibit noradrenergic neuronal firing in the locus coeruleus in the brainstem, which leads to loss of arousal through activation of endogenous sleep-promoting pathways. Although patient cooperation can also be achieved with other sedatives, the appropriate dose titration facilitates cooperative sedation more easily within the recommended dose range. Hall et al. demonstrated that healthy volunteers (0.2 or 0. μ 6 μ g / kg / h) could be easily returned to sedation when used alone.

Dexmedetomidine showed a dose-dependent sedative effect. If given at a large enough dose, DEX produces deep sedation and even general anesthesia, suggesting the potential to be part of an intravenous anesthesia strategy alone. However, the cardiovascular effects of dexmedetomidine may limit this application, especially in patients with poor health status. Despite dose-related sedation, DEx administration does not impair memory and cognitive function.

Dex can provide adequate sedation for critically ill patients. In earlier clinical trials, dexmedetomidine was similar to propofol, and the mean time to extubation was also comparable. Compared with the propofol group, the dexmedetomidine group was mostly lower, but not less than 60 beats / min, and the opioid requirement was significantly reduced. Furthermore, recent studies suggest that dexmedetomidine reduces the duration of mechanical ventilation[8].

2.2. Analgesia

The analgesic properties of dexmedetomidine are mediated by multiple mechanisms, including spinal, supraspinal, and peripheral actions. However, the analgesic efficacy of dexmedetomidine is controversial. In healthy volunteers, the upper limit effect shown in the ischemic pain model was greater than 0.5 μ g / kg. However, the dose-dependent analgesic effect of DEDEmedetomidine was evident in broad plasma concentrations from 0.5 to 8.0 ng / ml. Opioids with dexmedetomidine work very well. It has been documented in some clinical trials that even as the only pain medication, such as the dose of 0.4 μ g / kg dexmedetomidine after laparoscopic tubal ligation can be effective in pain relief, although sleepiness and bradycardia may be adverse side effects of the recovery period. A recent meta-analysis of 21 randomized trials demonstrated that intraoperative dexmedetomidine performed better for general anesthesia than remifentanil and had lower pain scores, less hypotension, chills, and less postoperative nausea and vomiting within 24 hours after surgery[9].

When administered via the neuraxial pathway, DEhas an anti-painful effect on both somatic and visceral pain[10]. A recent meta-analysis including 16 randomized controlled trials demonstrated that application of dexmedetomidine significantly reduced postoperative pain intensity and prolonged analgesia, but increased the risk of bradycardia[11]. Furthermore, the potential use of dexmedetomidine in the treatment and prevention of neuropathic pain was investigated. In a rat model, local injection of dexmedetomidine produced anti-hyperalgesia effects in neuropathic pain induced by spinal nerve ligation[12]. Furthermore, the use of intravenous dexmedetomidine reduces pain syndrome after thoracotomy for coronary artery bypass surgery[13].

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2.3. Side Effect

The most frequently observed side effects include circulatory abnormalities due to postsynaptic α 2 receptor activation, such as hypertension, bradycardia, hypotension, and dry mouth and nausea. Studies have shown that other side effects of dexmedetomidine include fever, muscle weakness, bronchospasm (especially asthma), respiratory depression, conduction abnormalities, arrhythmia, atrial ventricular block, tachycardia, syncope, neurological syndromes, sensory abnormalities, potassium abnormalities caused by electrocardiogram changes, lactic acidosis and elevated blood sugar[14]. A tachykinin response also occurs if an intravenous infusion exceeds 24 h.

3. Effect of dexmedetomidine use on ERAS

The ERAS pathway aims to promote the recovery of patients after surgery by combining multimodal perioperative care methods, including reducing the intense postoperative stress response, promoting intestinal recovery, and maintaining hemodynamic stability, and reducing the duration of mechanical ventilation[15], Cause the patient to recover early after surgery. Key elements of the ERAS protocol include preoperative counseling, nutritional optimization, standardized analgesia and anesthesia protocol (epidural and non-opioid analgesia), and early mobilization. Despite substantial evidence that ERAS programs can improve outcomes[16], But it has challenged the traditional surgical principles, and therefore their implementation has been slow[17]. ERAS programs have become an important focus for postoperative perioperative management. These programs attempt to modify the physical and psychological response to major surgery[16], And has been shown to reduce complications and hospital stay, improve cardiopulmonary function, and early restore gastrointestinal function and normal activities.

A key concept includes facilitating the use of intraoperative drugs with anesthetic and opioid-protective properties, such as the α -2 receptor agonist dexmedetomidine, which in turn may accelerate postoperative intestinal recovery. Key strategies to enhance ongoing perioperative pain management and reduce PACU time include the adoption of multimodal analgesic approaches and reduced opioid use. Thus, dexmedetomidine is a key component of multimodal analgesic approaches. Numerous studies have shown that dexmedetomidine works better than other drugs in the perioperative period[19]. For example, dexmedetomidine has excellent pain control in several types of laparoscopic procedures (e. g., gastrointestinal and gynecological procedures) as well as open surgery (e. g., gastrointestinal, spinal and abdominal hysterectomy). Higher reported satisfaction with dexmedetomidine treatment may be related to reduced pain and decreased postoperative nausea and vomiting (PONV). For these reasons, many anesthesiologists choose to use dexmedetomidine as part of the multimodal analgesia. The important role played by the use of DEDEmedetomidine in ERAS is illustrated below.

3.1. Effect on the recovery of the gastrointestinal tract function

Restoration of gastrointestinal (GI) function is an important marker of postoperative recovery in patients undergoing general anesthesia surgery, especially in patients undergoing abdominal surgery. With the advent of ERAS, the safe and effective promotion of gastrointestinal functional recovery plays an important role in rapid postoperative recovery and is an important consideration for anesthesiologists and surgeons[20]. Delayed recovery and postoperative gastrointestinal dysfunction prevented the patient from returning to normal diet and may lead to postoperative nausea and vomiting, abdominal distension, and ileus. Moreover, it can also increase the incidence of anxiety and insomnia. These events may affect the patient's quality of life, prolong their hospital stay, increase the associated costs, and even increase the perioperative mortality[21].

The following factors affecting the postoperative recovery of gastrointestinal function are: (1) surgical trauma and stress[22]; (2) Disruption and damage of normal gastrointestinal structures, followed by inflammation, can also delay postoperative gastrointestinal recovery[23]. (3) The use of analgesics during and after surgery can inhibit intestinal function[24]. Furthermore, opioid use can aggravate gastrointestinal dysfunction and delay gastrointestinal recovery through peripheral effects[25]. (4) The patient's own condition.

In the present study stage, there are two main views of dexmedetomidine in the recovery of gastrointestinal function after general anesthesia surgery. The first one is that dexmedetomidine helps to promote the recovery of gastrointestinal function in patients under general anesthesia[26]Scholars who

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support this view believe that dexmedetomidine can improve the activity of the vagus nerve, and then promote the peristalsis of the gastrointestinal tract. On this basis, the secretion function of the gastrointestinal tract is also enhanced, the digestive ability of food in the gastrointestinal tract is enhanced, and the desire to eat becomes more intense[27]. Scholars supporting another view believe that dexmedetomidine inhibited postoperative recovery of gastrointestinal function[28]. The view was held by a foreign scholar, whose team used morphine (a drug known to inhibit the recovery of gastrointestinal function) and found experimental data similar to morphine[29], To conclude that dexmedetomidine suppresses the recovery of gastrointestinal function, but there is no mechanistic study on this argument.

Current solutions to this problem are conservative, including early implantation, reduced opioid use, intravenous infusion and antiemetic medication, and nasogastric tube placement; however, the effects of these interventions are sometimes limited. Since the delayed recovery of postoperative gastrointestinal function is often caused by various factors, it is crucial for anesthesiologists to select appropriate anesthesia, maintain appropriate intraoperative management and apply appropriate interventions to promote the recovery of patient gastrointestinal function. With the increasing incidence of diseases with surgical indications, so does the number of patients requiring general anesthesia. Surgical manipulation and analgesia can lead to postoperative gastrointestinal dysfunction. Normally, after gastrointestinal surgery, gastric motility recovers at 24-48 hours, small bowel motility at 12-24 hours, and colonic motility at 3-5 days[30]. Many studies have aimed to explore ways to promote postoperative gastrointestinal recovery. These studies have explored the following approaches: (1) multimodal analgesia for reducing the use of opioids, such as other analgesic methods and the use of non-steroidal anti-inflammatory drugs (NSAIDs)[31]; (2) Laparoscopic surgery; (3) Target-directed fusion therapy; (4) Early enteral nutrition; (5) Chew the gum; (6) Use of opioid receptor antagonists[32]; (7) Traditional Chinese medicine. All of these methods have limited deficiencies in the postoperative recovery of gastrointestinal function. Surgical operation and anesthesia analgesia can lead to postoperative gastrointestinal dysfunction, inhibition of gastrointestinal function can lead to gastrointestinal dysfunction and discomfort, it can lead to system inflammation, and even multiple organ dysfunction syndrome.postoperative recovery of gastrointestinal function can enable the body to obtain enough nutrition as soon as possible, improve the recovery rate, reduce the economic costs of the family, and shorten the length of hospital stay. Long-term suppression of gastrointestinal function after gastrointestinal malignancy increases the incidence of postoperative complications, such as intestinal adhesion, abdominal contraction, abdominal infection, and anatomical leakage[33]. Therefore, it is important to study the influencing factors of gastrointestinal function recovery for gastrointestinal treatment in patients.

3.2. Breathing

Unlike other sedatives or anesthetics, dexmedetomidine causes less respiratory depression even with large doses. In contrast to the infusion of opioids, benzodiazepines, or propofol, dexmedetomidine can be safely infused in the presence of endotracheal intubation. This property of dexmedetomidine provides robust protection against adverse respiratory events in specific circumstances (e. g., awake cranial surgery and awake intubation). Dexmedetomidine maximizes patient discomfort, such as spontaneous breathing during awake intubation. Dry mouth is also one of the effects of dexmedetomidine, and its antisialic acid effects help to produce a dry visual field during awake intubation. Although the risk of bradycardia and hypotension should be considered, these events can be easily controlled with the use of atropine and vasoactive agents. Ventiatory response to hypercapnia is observed with dexmedetomidine and decreases with age but causes respiratory depression, especially in the elderly, in combination with other respiratory-inhibiting hypnotics or opioids. Therefore, it is approved for ICU sedation and requires continuous cardiac and respiratory monitoring. However, the overall effect of dexmedetomidine on the respiratory system was minimal when combined with other anesthetics. Dexmedetomidine also showed protective effects to reduce oxidative stress resulting from acute lung injury (ALI) by inhibiting the production of ROS (reactive oxidized substances). This is due to its activation of α -2 adrenoceptor effects, which can promote cell survival and alveolar epithelial cell proliferation in acute lung injury. Therefore, dexmedetomidine has been selected as a sedative for patients with ALI[34].

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3.3. Cardiovascular effects

The cardiovascular effects of dexmedetomidine have a biphasic hemodynamic response. High-dose DEX can cause tachycardia and elevated blood pressure, while smaller doses reduce blood pressure and reduces cardiac output. This is caused by α -2-mediated vasoconstriction, which ultimately leads to increased baroreceptor-mediated bradycardia and vagal activity, resulting in hypotension. Dexmedetomidine also leads to a decrease in circulating catecholamines due to its sympathetic effects. If injected in the push form by a rapid infusion, dexmedetomidine loses its α -2 receptor agonism, resulting in increased blood pressure and lower heart rate, but it normalized within 15 minutes. This effect is mainly mediated through the central α -2a receptor. It can also cause hypertension due to the activation of α -2b receptors. Therefore, extra care should be taken when using dexmedetomtiming in patients with physical weakness and potential cardiac risk. High doses of dexmedetomidine can cause pulmonary hypertension, which may be a limiting factor for its use in patients with underlying heart disease.

3.4. Kidney effect

The effects of dexmedetomidine on renal function are complex, including diuretic effects produced by inhibiting the antidiuretic effect of vasopressin (AVP) in the collecting tube, increased osmotic pressure clearance through an AVP-independent pathway, and increased renal blood flow by reducing norepinephrine release from the renal cortex. There is also evidence that dexmedetomidine attenuates ischemia-reperfusion injury in mice. A recent study reported that the perioperative infusion of dexmedetomidine decreased the incidence and severity of acute kidney injury after heart valve surgery.

3.5. Neurosurgery

Dexmedetomidine with or without remifentanil has become the most useful drug for providing a safe and acceptable condition during neurosurgical procedures in awake patients[35]. Especially in awake craniotomy, this requires complicated neurological evaluation, and some studies suggest many advantages of Dex[36]. The sedative effects of dexmedetomidine require neurological evaluation while avoiding tachycardia and hypertension. Furthermore, dexmedetomidine has potential neuroprotective effects, including decreased intracranial pressure and a dose-dependent reduction in cerebral blood flow and brain metabolic rate[37]. These neuroprotective effects may be due to the modulation of neurotransmitter release in the central and peripheral sympathetic nervous system. A recent randomized controlled trial demonstrated that dexmedetomidine sedation during awake craniotomy had similar EEG changes collected with propofol-remifentanil sedation. Furthermore, adverse respiratory events were less in the dexmedetomidine group. Dexmedetomidine has been successfully used in awake craniotomy in children[38].

3.6. Gynaecology

Laparoscopic hysterectomy is the second most common gynecological procedure. Postlaparoscopic pain is less severe than laparotomy, but there may be pain during the operation, which may affect the nervous system and inflammatory reaction[39]. Furthermore, approximately 32% of patients develop chronic pain after hysterectomy that does not disappear after a year. Therefore, controlling inflammation and pain may have clinical implications for patients undergoing laparoscopic hysterectomy. Dexmedetomidine is a α -2 adrenergic receptor agonist with high selectivity in the central nervous system, with the effects of sedative, anxiolytic, shivering, analgesic, and anesthetic saving[40]. Dex also reduced inflammation and stress responses and was identified in a meta-analysis with a significant reduction in serum inflammatory markers. In one study, dexmedetomidine reduced postoperative pain in patients undergoing laparoscopic hysterectomy at every time point and in the post-anesthesia care unit (PACU). The inflammatory responses representing TNF- β, IL-6, IL-10, and CRP were similar between the two groups. The dexmedetomidine group was discharged from the PACU until 24 hours after surgery. Heart rate remained low in patients treated with dexmedetomidine during anesthesia and surgery. Intraoperative infusion of dexmedetomidine at 0.4 g / kg / h significantly reduced postoperative pain, but not the inflammatory response in patients undergoing laparoscopic hysterectomy.

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3.7. Old age

Side effects are particularly pronounced in older elderly, especially in hemodynamics. The hypotension may result if the loading dose used is greater than 0.7 μ m / kg. Because to the high incidence of hypotension and bradycardia in the elderly, caution is recommended to use dexmedetomi timing in the elderly because they often have many comorbidities. For patients requiring continuous infusion, continuous monitoring of pulse oxygen saturation and ECG is recommended, especially in patients with ventricular ejection fraction less than 30% or with other potential cardiac comorbidities.

3.8. Pediatrics

Dexmedetomidine has been widely used in pediatric intensive care, pediatric cardiac, and general surgical patients. Its sympathetic effects are often beneficial in patients undergoing cardiac surgery[41]. The recommended adult dose can also be administered to children, with a loading dose of 0.25 to 6 μ g / kg / h within 10 minutes and a maintenance dose of 0.2 to 1.4 μ g / kg / h. The clearance rate of neonatal dexmedetomidine is about 50% and eventually becomes the adult level as the newborn ages. Neonborns have a large volume of distribution due to their liver immaturity and lower albumin levels and have the effect of increasing elimination half-life. In addition, higher dexmedetomidine concentrations can be found in the neonatal brain due to the immature blood-brain barrier. At lower doses, no cardiopulmonary side effects occurred, but dexmedetomidine has been reported to reduce body temperature and bradycardia in neonates. In older children, DEwas well tolerated and had similar efficacy as in adults. Intraoperative use of non-opioid analgesics (e. g. dexmedetomidine) as part of the ERAS protocol for regional neurological blockade to achieve satisfactory postoperative outcomes and reduce opioid requirements in PACU in pediatric patients. With the need of sedation requirements during diagnostic procedures such as MRI, outpatient clinics, dexmedetomidine has become a powerful option for non-intravenous sedation routes, especially for at least 45 minutes and buccal dosing of 2-3 μ g / kg before the chosen time. This could provide adequate sedation for approximately 80% of patients, while other modes of sedation are required in 20% of failures.

3.9. Obesity

It is important to monitor the breathing in obese patients. They are more likely to have OSA, which may further complicate the problem when dexmedetomidine is used in combination with other opioids. The beneficial effects of using dexmedetomidine include reduced use of volatile gases, reduced opioid demand and better pain control as well as reduced need for antiemetic medication.

Admito Delusions is an acute state of confusion in which the cognitive function is impaired and the state of consciousness is abnormal. After stopping the anesthetic after the surgical procedure, most patients will smoothly regain normal consciousness. A small number of patients may eventually develop false symptoms, with a higher risk of disease in children and the elderly. The morbidity in pediatric patients is reported to be up to 80%, which may increase the risk of postoperative respiratory depression and airway obstruction. Among the many available drugs, dexmedetomidine has been found to be beneficial, especially in sevoflurane-induced emergency delusion, and the use of 0.5 μ g / kg dexmedetomidine is beneficial to reduce the incidence of delusion and adverse postoperative behavior changes (NPOBC). Dexmedetomi was scheduled after induction of anesthesia and the patient must be kept in cardiopulmonary monitoring. There are limited data on poor postoperative behavior change, but up to 50% of children undergoing surgery under general anesthesia exhibit certain behavioral symptoms, including, but not limited to, crying, irritability, eating and sleeping problems, temper, nightmares, etc., from the day to or a week after surgery. Dexmedetomidine can reduce and limit such symptoms when quantified through the pediatric anesthetic emergency delusion (PAED) scale. Although the incidence of agitation was less common in the pediatric age group, the incidence was approximately 35% lower when sevoflurane was combined with dexmedetomidine. A recently published study showed that infusion of dexmedetomidine results in decreased noradrenaline and epinephrine, suggesting that the effect is primarily by reducing catecholamines rather than through anti-inflammatory effects. It was found in patients treated with dexmedetomidine compared with midazolam. Even with lorazepam, the risk of dexmedetomidine was low. Therefore, dexmedetomidine can be used prophylactic or in emergency to prevent or control the occurrence of delusion. For patients at risk, 0.25 μ g / kg dexmedetomidine may be administered slowly and intravenously, and 0.5 μ g / kg may be administered for patients requiring urgent treatment.

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4. Current status of the clinical application

As mentioned previously, dexmedetomidine largely reduces opioid dependence for postoperative analgesia. In a double-blind randomized controlled study, the preoperative administration of dexmedetomidine alone at 0.5 μ g / kg demonstrated a clinically significant reduction in the use of anesthetics and opioid drugs in patients undergoing ureteroscopy or ureteral stenting. During laparoscopic surgery, the loading dose was 1 μ g / kg and then a maintenance dose of 0.5 μ g / kg / h for the rest of the procedure with similar results. Postoperative analgesia was 50 minutes in the control group versus 360 minutes in the dexmedetomidine group. The total 24-hour analgesic requirement was also significantly less in the dexmedetomidine group than in the control group. A recent meta-analysis involving 18 studies and 1284 patients showed that the combination of dexmedetomidine with opioids for patient-controlled analgesia reduced overall opioid utilization with no increase in adverse effects. Dexmedetomidine has been paired with propofol to achieve intravenous anesthesia without opioid substances during gynecologic laparoscopy. The results showed to improve pain scores and reduce the amount of analgesic used. The effects of dexmedetomidine on local anesthetic agents and nerve blocks were also investigated. Dexmedetomidine significantly prolonged the postoperative analgesia in children undergoing small bowel nerve block hernia repair. When combined with bupivacaine for epidural anesthesia, it has better analgesia and fewer adverse effects compared with fentanyl. When ropervacaine was given intraperitoneal combined for pain control after laparoscopic cholecystectomy, it outperformed fentanyl. Other studies have shown that dexmedetomidine significantly reduces the incidence of postoperative nausea. There is evidence that dexmedetomidine administration 30 minutes before surgical completion reduces the frequency and severity of nausea in a high-risk population. One study showed that the incidence and severity of delusion were reduced in patients with lung cancer resection. Other trials have shown that dexmedetomidine reduces adverse behavioral changes and agitation in pediatric patients without excessive sedation or other adverse side effects. The major side effect of many of these studies is hemodynamic instability in the form of bradycardia and hypotension. These changes, although statistically significant, were well tolerated by most study participants. Several studies have shown this to be beneficial because it can reduce the haemodynamic stress response produced by surgical trauma.

5. Conclusion

ERAS is a patient care approach focused on optimizing postoperative treatment. This includes implementing a protocol designed to reduce postoperative complications, patient discomfort, and length of hospital stay. Dexmedetomidine, a highly selective α -2 adrenergic agonist, has become an important complement to a variety of methods in anesthesia. Its sedative, anxiolytic, and analgesic effects can be used to enhance the postoperative analgesic effect. These features make it a useful adjuvant for the anesthetic regimen, especially when the postoperative recovery is enhanced. Dexmedetomidine acts on the locus coeruleus and spinal cord to inhibit the presynaptic release of norepinephrine, which exerts sedative, analgesic, and inhibitory centrally mediated sympathetic effects. The use of dexmedetomidine reduced the need for anesthetics and opioids both during and postoperatively. Dexmedetomidine has also been shown to reduce the occurrence of postoperative nausea, vomiting, delusion, and agitation, and with minimal effects on respiratory drive. These functions make it an important medication to achieve the goal of improving recovery after surgery. It has been used as a sedative in the ICU, as an adjuvant for epidural and peripheral nerve blocks, and for preoperative anxiolysis. Additional research is necessary to better understand the widespread application of dexmedetomidine. The main adverse events providers should care for during dexmedetomtiming are hemodynamic instability, namely bradycardia, hypotension and hypertension. The study found an almost 2-fold increase in bradycardia in patients receiving intraoperative dexmedetomidine compared to no controls. Meanwhile, Shariffudin et al found that SBP was decreased significantly at 15 min after DEX infusion, a phenomenon that disappeared after 20 min, It appears that these episodes of hemodynamic disturbances are related to the use of a loading dose or a rapid initial infusion rate. One way to mitigate this is to discard load pushing with a slower base infusion rate. Although these hemodynamic changes are not a problem for most patients, providers should exercise caution in dexmedetomtiming in patients with bradycardia, including those with heart conduction abnormalities or taking drugs that alter heart conduction and in the elderly. Furthermore, attention should be paid to adjust the dose in patients with liver insufficiency because dexmedetomidine is mainly metabolized in the liver. Although dexmedetomidine has been shown to be a relatively safe agent, the lack of antagonists remains a problem. Alpiprazole is a synthetic α -2 antagonist, has been shown to reverse the effects of dexmedetomidine. However, only is currently approved for animals.

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This requires more studies to evaluate the efficacy and safety in the human body. Dex is a more attractive option when effective antagonists are developed and used. Currently, only few data can address the potential neuroprotective, cardioprotective, and renoprotective effects. Dexmedetomidine has been tested mainly in mainly animal models, but is encouraging enough to warrant future research in humans.

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