

Sedation for Pediatric Patient with End-Stage Hepatic Disease Outside Operating Room

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Abstract

Sedation outside operating room for children has increasing importance. Pediatric patients with end stage liver disease are of great importance for various and frequent procedures including gastrointestinal endoscopy, magnetic resonance imaging, computerized tomography, brachytherapy, catheterisation, interventional radiology. Anesthesia plan plays critical role for the success of these procedures. Patient safety, ventilation, hemodynamic responses, side effects of anesthetics on liver and periprocedural analgesia are the main topics of attention. Airway management tools may be helpful because of edema and ascites pushing diaphragm upwards. Nasal capnography enables monitoring spontaneous ventilation. Enlargement of extravascular extracellular fluid and dysproteinemia, effects drug behaviors. Drug elimination half-time as well as context sensitive half-time have to be taken into account and designed individually. The pressure above vena cava inferior, results with decrease in preload, thus reduction in cardiac output. Pulse wave variation monitoring helps for estimating circulating fluid status. Tendency for bleeding can be anticipated with fresh frozen plasma. Patient-controlled analgesia may be a choice of favor but close monitoring required for repeated analgesics. Children's Hospital of Eastern Ontario Pain Scale would be a good monitoring tool for pain.

Keywords: Anaesthesia; Sedation; Pediatric; End-stage liver disease

Introduction

History for sedation for pediatric population

The first guideline was published by American Academy of Pediatrics in 1985. Historically, chloral hydrate and pentobarbital have been used for pediatric sedation in radiology departments for a long time [1]. Both drugs are medications which each have nearly 100 years of clinical experience. They have been associated with prolonged recovery times and sedation-related morbidity, because of their extended half-life [2].

Conscious sedation itself would lead to serious complications, even to mortality in non-skilled hands or in not well organized units. A combination of midazolam, alfentanil, and ketamine was administered to a child for dental treatment to have sedation. He had apnea and permanent hypoxic brain damage [3]. Both proceedings in technology and experience of complications have led anesthesia outside operating room for pediatric population.

Effects of end-stage liver disease on pediatric patient

Cirrhosis is a progressive condition characterized by fibrosis and nodule formation in the liver due to a number of etiologies. Cirrhotic children can have well-compensated disease with little symptoms or present with decompensated disease, including ascites, encephalopathy, gastrointestinal bleeding, portal hypertension, hepatorenal syndrome, sepsis, dyspnea, nausea, vomiting, jaundice, elongation in prothrombin time, hypotension, pleural effusion, fever, peptic ulcer, cholelithiasis, renal failure, adrenal failure and hyponatremia [4-6].

Procedures outside operating room for pediatric patients with end-stage liver disease

Percutaneous endoscopic gastrostomy, gastro intestinal endoscopy, endoscopic retrograde, cholangiopancreatography, endoscopic mucosal resection, submucosal dissection, magnetic resonance enterography, cardiac catheterization laboratory, radiation therapy are the most frequently choices [7-9].

Anaesthetic considerations

At the beginning of anaesthesia team have to evaluate the patient. Informed consent, verbal and written instructions, the child's medical history of anesthetic importance, physical exam is necessarily steps. At the end a risk assessment according to American Society of Anaesthesia (ASA) physical status classification system is defined for the patient [10]. Liver disease may impair the metabolism of drugs used for sedation. Liver dysfunction could reduce the clearance of the drugs, biliary excretion and plasma protein binding. End-stage liver disease is also associated with a reduction in the activity of the CYP450 enzymes [11]. It is necessary to adjust the dose of anaesthetic drugs eliminated by renal excretion. Mask ventilation can be complicated because of edema in upper airways, pleural effusion, and ascites forcing diaphragm caudally. Insufflation of air from the endoscopy device to the gastrointestinal tract will also complicate increased intra-abdominal pressure and make ventilation difficult. The anaesthesia team will decide the level of the sedation taking into account both the procedure and the patient. Light sedation/anoxiolysis, moderate sedation, deep sedation, dissociative sedation and general anesthesia are the choices [12,13].

Monitoring during the procedures

Noninvasive/invasive blood pressure, pulse oxymeter, capnography, bispectral index, cerebral oxymeter, core temperature and urinary output are used for patient safety and anaesthesia depth.

Drugs

These drugs for sedation outside operating room are a mixture of old and new drugs. According to the protocol used in the institution their doses alone and in combination with other anesthetics differ. But the main consensus is titration of the drugs after a low dose given in a short time [14].

Midazolam is a benzodiazepine derivative drug [15]. Diazepam is a benzodiazepine drugs that work on central nervous system. Chloral hydrate is transformed to the active compound trichloroethanol, which acts barbiturate-like effects on GABA-receptor. Propofol is a hypnotic alkylphenol derivative. Most centers prefer propofol instead of benzodiazepines and opioids because of its short half-life and lower risk of inducing hepatic encephalopathy. Fentanyl is a synthetic opioid related to the phenylpiperidines. Remifentanyl is a 4-anilidopiperidine derivative of fentanyl. Unlike other opioids, it is rapidly metabolized by hydrolysis by nonspecific blood and tissue esterases [16,17]. Meperidine is an opioid pain medication. The onset of action is slightly more rapid than with morphine. Ketofol is a mixture of ketamine and propofol [18]. Ketamine is a phencyclidine derivative [19]. Thiopental is a barbiturate. Dexmedetomidine is a highly selective 2 adrenoceptor agonist that has sedative and analgesic effects Alpha 2 receptor agonist [20-23]. Flumazenil and naloxone are reversal drugs for benzodiazepines and narcotics, respectively.

Periprocedural complications

Agitation, delirium, airway obstruction, allergic reaction, apnea, aspiration of gastric content, cardiac arrest, desaturation, hypothermia, inadequate anesthesia, IV related complication, laryngospasm, prolonged recovery time, secretions requiring treatment, laryngospasm, stridor, unexpected need for bag-mask ventilation, unplanned intubation, prolonged recovery and seizure.

Conclusion

Both anesthesia and non-anesthesia staff have confidence performing sedation for pediatric population outside operating room. This is partly because of high technology monitoring tools and partly experience gained and shared with publications. Performing anesthesia outside operating room will provide much more help than expected for diagnostic and therapeutic procedures.

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