Ain Shams University
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A Comparative Study Between Adjuvants to Caudal Bupivicaine in Duration of Analgesia and Attenuation of Stress Response in Pediatrics

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دراسة مقارنة لبيان تأثيرالعقارات المضافة للبيوبيفيكاين في تخدير ما فوق الأم الجافية الذيلي على مدة التسكين و تخفيف الإستجابة التوترية في الأطفال

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Stress Responce

Stress responses to surgical trauma and postoperative pain elicit changes in hormonal secretion ***(Solak et al., 2000)***.

Surgery is associated with metabolic and endocrine responses characterized by hyperglycemia, an increase in adrenocorticotropic hormone, cortisol, prolactin, antidiuretic hormone, growth hormone, catecholamines, angiotensin II, aldosterone, glucagons, IL-1 and lactate, and decrease in insulin and testosterone ***(Bozkurt et al., 2000)***.

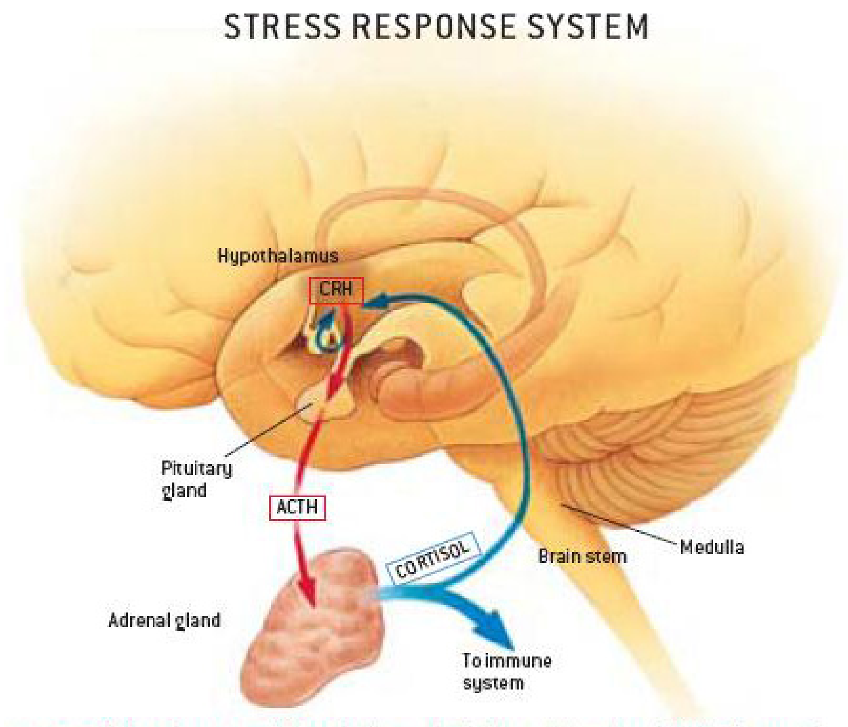

Figure (1): Stress response system ***(Bozkurt et al., 2000)***

Previous reports have demonstrated that blood levels of epinephrine and norepinephrine were decreased by caudal epidural analgesia, using local anesthetics alone, caused by afferent neural blockade ***(Gaitini et al., 1999)***.

The net effect of increased levels of the previously mentioned hormones is to promote the provision of substrates from the catabolism of stored fuels for a maximum chance of survival ***(Kehlet, 1998)***.

Surgical trauma elicits a metabolic response by activation of the sympathetic and somatic nervous system and through local trauma. The neuroendocrine stress response has both an afferent and an efferent pathway as well as a central integrative component ***(Kehlet, 1998)***.

Pain, both somatic and visceral, represents the major afferent pathway. The efferent pathways of the neuroendocrine response include sympathetic nervous system activation as well as the release of a host of neuroendocrine hormones, including adrenocorticotropic hormone, cortisol, rennin, angiotensin, aldosterone, catecholamines (epinephrine and norepinephrine), and vasopressin ***(Hagen et al., 1980)***.

These responses begin during surgery with elevated stress hormones maintained for days after. There are a number of potential adverse physiologic sequelae of surgical trauma and unrelieved pain that relate in varying degrees to the neuroendocrine stress response. These include (1) cardiovascularstress, (2) autonomic hyperactivity, (3) tissue breakdown (production of a catabolic state with suppression of anabolic hormones), (4) increased metabolic rate, (5) pulmonary dysfunction (most significant after upper abdominal and thoracic surgery), (6) increased blood clotting (hypercoagulability), (7) fluid retention, (8) dysfunction of the immune system, (9) delayed return of bowel function (ileus). The adverse physiologic sequelae of surgical trauma that relate more directly to the neuroendocrine stress response include hypertension, tachycardia, protein catabolism, immune system suppression, and impaired renal function***(Kouraklis et al., 2000)***.

More directly as a consequence of the neuroendocrine stress response, blood glucose concentration increases as a result of increased hepatic glycogenolysis and gluconeogenesis prompted by increased cortisol and catecholamines. In addition, peripheral use of glucose is decreased. It is now established that poor glucose control is associated with increased wound infection and impaired wound healing. Another adverseeffect as a direct consequence of the neuroendocrine stress response is protein catabolism, which is influenced by increased cortisol concentrations ***(Kouraklis et al., 2000)***.

The breakdown products from skeletal muscles and to a lesser degree, from visceral muscle proteins are used by the liver either to synthesize acute-phase proteins or to be converted to other fuel substrates. Significant protein catabolism results in marked weight loss and muscle wasting in patients after major surgical and traumatic injury ***(Kouraklis***

et al., 2000).

Increased lipolytic activity stimulated by cortisol, catecholamines and growth hormone, results in mobilization of triglyceride to form glycerol and fatty acids, which in turn provides substrates for gluconeogenesis or ketones. Increased arginine vasopressin and aldosterone secretion may result insalt and water retention, supporting the preservation of adequate body fluid volumes ***(Kouraklis et al., 2000)***.

Accordingly, interventions that modify or reduce the severity and duration of the surgical stress response are more successful in completely blocking these responses when they are less severe.

Aim of the Work

This is a prospective interventional study which aims to evaluate and compare the effect of addition of morphine vs. dexmedetomidine vs. ketamine as adjuvant to bupivacaine in preoperative caudal epidural block to prolong its anesthetic action and to decrease stress response after lower abdominal surgery in children.

Caudal Block

Epidural anesthesia has been used for many years in pediatrics not only as an adjuvant to a general anesthetic but also as a sole anesthetic for subumbilical procedures ***(Dalens, 2000).***

Caudal epidural anesthesia is used as pain control for many subumbilical surgical procedures.It has been demonstrated that pre-surgical caudal analgesia attenuates the stress response of anesthesia and surgery and decreases postoperative narcotic use (***Dalens, 2000).***

Local anesthetics as well as its adjuvants have been researched to optimize the injectate of the caudal block to increase the duration of analgesia.

Technique

The caudal approach, in contrast to the lumbar or thoracic approach, is used in children due to the ease of access to the caudal epidural space via the sacrococcygeal ligament and the potential decreased risk of injury to neural structures at this level.

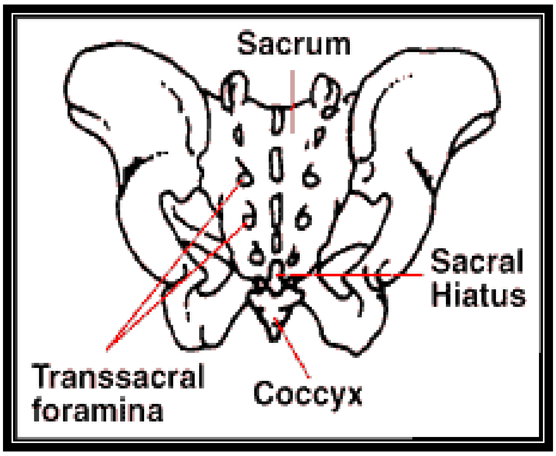

Figure (2) Anatomy of the caudal space ***(Brown, 1999).***

Technical aspects:

Positioning and preparation; to perform a caudal block, the child is placed in the left lateral position with the upper hip flexed 90 degree and the lowerone only 45 degree ***(Gerber and Weiss, 2003).***

Intense disinfection with an alcoholic solution, sterile drapes and the use of sterile gloves should be standard for every neuraxial block ***(Bernbach et al., 2003).***

Puncture site: The posterior iliac spines and sacral hiatus form the edges of an equilateral triangle.

Epidural puncture is achieved in the most proximal region of the sacral hiatus, cranial to the edge of the equilateral triangle. The palpating index finger of the left hand lies on spinous process of S4. Commonly a short 20 or 22 gauge beveled needle is advanced at a 45° to 90° angle at the level of the sacrococcygeal ligament into the skin (Figure 2). After perforating the membrane, the needle should only be minimally advanced, no more than 1-3 mm, in order to avoid a bloody puncture or an intrathecal injection.

Figure 3(A) **Figure 3(B)**

Figure (3): (A) Needle approach in caudal epidural block. **(B)** Aspiration before injection ***(Hogan and Toth, 1999).***

Once the "pop" or loss of resistance through the sacrococcygeal ligament is felt, the angle of the needle is decreased to approximately 30° and is advanced a few millimeters. This advancement assures complete insertion of the tip of the needle, including the bevel into the sacral canal. Proper placement of the needle as well as the injectate solution.

The absence of subcutaneous bulging of tissues and the lack of resistance with injection of local anesthetic are some common signs used to assure proper needle placement.

Alternatively, a description of the whoosh versus modified swoosh is described by injecting 1 mL of air or saline, respectively, while listening with a stethoscope over the lower 2nd lumbar spine ***(Talwar et al., 2006).***

Cardiovascular effects:

According to common teaching, neuraxial blockade causes only minimal changes of blood pressure in children. Occasionally, however severe hypotension may occur and regular blood pressure measurements are mandatory. In awake infant, the blood pressure cuff is best placed in the lower limb in order to leave the patient undisturbed ***(Gerber and Weiss, 2003).***

Contraindications

a) Presence of a significant spinal defect.
b) Infection of the skin or subcutaneous tissue in the puncture area.
c) Coagulation defects.
d) Neurological defects in growth, as well as demyelinating disease of the CNS.
e) Refusal of the parents.
f) Allergy to local anesthetics.
g) Severe hypovolemia.
h) Uncontrolled convulsions ***(Weisman, 1998).***

Advantages

a) Regional nerve block causes deep muscle relaxation below the level of block.