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Review

PERIPHERAL NERVE BLOCKS FOR HIP FRACTURES IN EMERGENCY MEDICINE

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SUMMARY – Hip fractures represent a major public health issue with increasing incidence as a population ages. The aim of this review is to describe peripheral nerve block techniques (the fascia iliaca compartment block and the pericapsular nerve group block) as pain management for hip fractures in emergency medicine, and to emphasize their benefits. Hip fractures are extremely painful injuries. The pain itself is unpleasant for patients and if left untreated it can lead to multiple complications during preoperative, operative and postoperative patient management. Pain management for elderly hip fracture patients is often challenging. Non-steroidal anti-inflammatory drugs are not recommended due to their side effects, the increased risk of gastrointestinal bleeding, renal function impairment and platelet aggregation inhibition. Paracetamol alone is often insufficient, and opioids have many potentially harmful side effects, such as delirium development. Peripheral nerve blocks for hip fractures are safe and effective, also in emergency medicine settings. The benefits for patients are greater pain relief, especially during movement, less opioid requirements and decreased incidence of delirium. Regional analgesia should be routinely used in hip fracture pain management.

Key words: *Hip Fractures; Pain Management; Nerve Block; Emergency Medicine*

Introduction

Hip fractures represent major public health issue with increasing incidence as a population ages.[1] The worldwide number of hip fractures in 1990 was 1.66 million and is estimated to increase to 6.26 million by 2050.[2] Approximately 75% of patients are women.[2-4] Hip fractures occur mostly in elderly patients after minor trauma, such as a fall from standing height.[2-4] One-year mortality among the elderly after a hip fracture is 30%, although novel studies suggest approximately 23%.[5]

Hip fractures are extremely painful injuries.[6] The pain itself is unpleasant for patients, and if left untreated it can lead to multiple complications during preoperative, operative and postoperative patient management.[7-9] The stress response represents physiological hormonal and endocrinal changes following trauma or injury, also known as the "fight or flight" response. The

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goal of stress response is to prevent further damage to tissue or the organism itself. But if prolonged, it consumes cell and tissue capacity to respond in a physiological way and causes pathophysiological disbalance. Inadequate pain management leads to prolonged stress response, which increases morbidity and mortality.[8-10]

Pain management in elderly hip fracture patients is often challenging.[11] Non-steroidal anti-inflammatory drugs are not recommended due to their side effects; increased risk of gastrointestinal bleeding, renal function impairment and platelet aggregation inhibition.[12] Paracetamol alone is often insufficient and opioids have many potentially harmful side effects[13,14] The role of regional analgesia, especially peripheral nerve blocks, is rising but they are still not used as often as they should.[11-5]

The aim of this review is to describe peripheral nerve block techniques for hip fractures in emergency medicine and to emphasize their benefits.

Peripheral Nerve Blocks

Fascia Iliaca Compartment Block

The fascia iliaca compartment block (FICB) was first described in 1989 by French investigator Dalens and his colleagues.[16] In FICB, a local anesthetic is injected beneath fascia iliaca to block simultaneously the femoral nerve, the obturator nerve, and the lateral cutaneous nerve of the thigh. At first it was performed as a "two-pops" technique with needle popping trough fascia lata and then fascia iliaca. The patient is in a supine position. The site of the injection is one centimeter distal from the medial two thirds and lateral third of a line between the anterior superior iliac spine and the ipsilateral pubic tubercule. It requires a large volume of local anesthetics, 30 to 40 ml, (0.25% levobupivacaine or 0.25% ropivacaine).[17] The advantage of FICB is a low learning curve and low complication rate, which is especially important for non-anesthesiologists, such as emergency medicine practitioners.[18-20] Today, FICB is performed with ultrasound guidance, which increases the success rate and decreases the rate of complications.[21]

Pericapsular Nerve Group Block

The pericapsular nerve group block (PENG) was first described in 2018 by Canadian investigator Girón-Arango and colleagues.[22] It requires a smaller volume of local anesthetic than FICB, 20 ml. PENG is performed with the patient in a supine position and injected with a local anesthetic between the psoas tendon anteriorly and the pubic ramus posteriorly. The authors used an ultrasound probe placed in a transverse plane over the anterior inferior iliac spine and then aligned with the pubic ramus by rotating the probe counterclockwise approximately 45 degrees. In this view the iliopubic eminence, the iliopsoas muscle and tendon, the femoral artery, and the pectineus muscle are clearly visible. The needle was then inserted in-plane. Some investigators have performed PENG without ultrasound guidance using nerve simulator[23] PENG is a relatively new technique and evidence is limited, but it appears that it could be even more effective than FICB, with a similar low learning curve.[24-25]

Methods

For purposes of this narrative review, we conducted s search of the MEDLINE and Cochrane databases in January 2022 to identify meta-analyses, systemic reviews and reviews published in last five years. The search key words were "hip fracture,*" "pain,, "peripheral nerve block,*" "analgesia," and "anesthesia" in various combinations. We identified 15 studies, 12 of them written according to the PRISMA statement and dealing with preoperative peripheral nerve blocks in hip fracture patients.

Results

Benefits of preoperative regional analgesia in hip fracture patients

Pain relief

Hip fracture patients experience severe pain, which becomes even stronger with movement. Patients must be moved from the site of trauma into an emergency medicine service vehicle, transported to emergency medicine department, transferred to an in-hospital stretcher, moved for radiological diagnostics, transported to a hospital bed, moved for personal hygiene, and finally transferred to an operating theater, where they are often positioned for regional anesthesia. As expected, preoperative regional analgesia provided significantly better pain relief to systemic analgesia alone, especially when dealing with pain on movement.[26-29].

Opioid requirements

Opioids have been used for a several centuries and remain potent analgesics when dealing with severe pain. Unfortunately, they have many well know side effects such as constipation, nausea and vomiting, etc. Among elderly, their role in developing delirium (an acute confused state) was controversial. Today, evidence supporting opioids as a factor in causing delirium is rising. So, it is of great importance to relieve pain in the elderly without opioids, or at least with a minimum dosage, if possible. Due to its effect on pain relief regional analgesia has been shown to decreases opioid requirements in hip fracture patients.[30-32]

Delirium – an acute confused state

Severe pain is one of the main risk factors for developing delirium among hip fracture patients. On the other hand, a second risk factor is opioid usage. Regional analgesia decreases the risk of developing delirium in hip fracture patients, particularly in the subgroup of patients with intermediate risk.[33-35]

Probable benefits

Preoperative regional analgesia probably shortens the time to mobilization after surgery, reduces the risk of pneumonia within 30 days from hip fracture, the hospital length of stay, and the cost of pain management for a single-shot block. With wider clinical use of peripheral nerve blocks, it will be possible to better evaluate these effects in observational studies.[36]

Safety

Data from multiple clinical studies demonstrate that FICB and PENG are safe and effective procedures[36]. However, as in every emergency medicine procedure, it is important to be aware of potential adverse events to reduce their incidence and effectively treat patients in jeopardy.

Potential adverse events in regional analgesia are structural damage of underlying tissue, such as nerves, major vessels or muscle tendons. Damage may occur due to needle placement or mechanical pressure of intra or perineural/peritendon injection.

And there is also a potential for developing local anesthetic system toxicity (LAST). The effects of LAST can be divided into two major groups: central nervous system toxicity (CNS) toxicity and cardiovascular system toxicity (CVS) toxicity. Early manifestations of CNS toxicity could be perioral paresthesia, confusion, audio-visual disturbances, dysgeusia, agitation, or reduced level of consciousness leading to seizures, loss of consciousness, coma, and respiratory arrest. CVS toxicity can display dysrhythmias, conduction deficits, hypotension, and eventually cardiac arrest. In case of LAST, local anesthetics injections must be stopped immediately. An antidot for local anesthetics is lipid emulsion and it must be available in emergency medicine settings during regional analgesia treatment. And of course, patients must be treated according to the emergency medicine ABCDE approach with the use of appropriate medications, if needed, (oxygen, saline infusion, benzodiazepines for seizures and adrenalin boluses less than 1 mcg/kg). However, the incidence of LAST is very low (0.04 to 1.8/1000 peripheral nerve blocks).[37,38]

Discussion

As shown above, the benefits of peripheral nerve blocks in pain management for hip fracture patients are evident. Current NICE guidelines recommend paracetamol every six hours, additional opioids if needed and regional analgesia if the pain has not abated.[3] The guidelines of the Association of Anesthetics and the American Academy of Orthopedic Surgeons guidelines recommend peripheral nerve blocks as a first line treatment in preoperative pain management for hip fractures. Surgery should be performed on the day of, or the day after, admission.[40,41] Peripheral nerve blocks are safe and effective in emergency medical settings, including out of hospital use.[42-47]

Evidence strongly supporting regional analgesia as a first line treatment of choice in preoperative pain management in hip fractures is paramount, but these procedures are still not widely accepted in clinical practice. The probable reasons are overcrowded emergency medical services and emergency medical departments, a shortage of trained personnel, the availability of equipment and behavioral barriers to provide reliable pain assessment, especially in elderly patients. The solution may be the introduction of educational programs and also defining pain management algorithms/care pathways for hip fracture patients. Also, it would be beneficiary to have more physicians and nurses working in emergency medicine.[48-52]

The limitations of this narrative review are the use of only two databases, and also that all of the included articles were written in English.

In conclusion, peripheral nerve blocks for hip fractures are safe and effective also in emergency medicine settings. The benefits for patients are greater pain relief, especially during movement, less opioid requirements and a decreased incidence of delirium. Regional analgesia should be routinely used in hip fracture pain management.

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Sažetak

BLOKOVI PERIFERNIH ŽIVACA U BOLESNIKA S PRIJELOMOM KUKA

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Prijelom kuka predstavlja značajan javno zdravstveni problem čija će incidencija rasti sa starenjem populacije. Cilj ovog preglednog članka je opisati blokove perifernih živaca u liječenju boli kod bolesnika s prijelomom kuka, (bloka ilijakalne fascije i bloka perikapsularnih živaca), te naglasiti prednosti njihove primjene. Prijelom kuka je izrazito bolna ozljeda. Bol sama po sebi je neugodna za bolesnika, a ukoliko je neodgovarajuće liječena može dovesti do višestrukih komplikacija tijekom prijeoperacijskog, operacijskog i poslijeoperacijskog zbrinjavanja bolesnika. Unatoč postojanju brojnih analgetika, liječenje boli u starijih bolesnika s prijelomom kuka često je zahtjevno. Nesteroidni protuupalni lijekovi se ne preporučuju radi svojih neželjenih učinaka, paracetamol je često nedovoljan, a opioidi također mogu imati brojne neželjene učinke, uključujući razvoj akutnog smetenog stanja. Primjena blokova perifernih živaca je sigurna i učinkovita, također u uvjetima hitne medicine. Koristi za bolesnike su bolje ublažavanje boli, osobito prilikom pomicanja, smanjena potreba za primjenom opioida i smanjena incidencija akutnog smetenog stanja. Primjena blokova perifenih živaca u liječenju boli kod bolesnika s prijelomom kuka trebala bi postati svakodnevnica u kliničkoj praksi.

Ključne riječi: *prijelom kuka; liječenje boli; blok živca; hitna medicina*