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RESEARCH ARTICLE

EFFECTIVENESS OF INTRAOPERATIVE PLACEMENT OF A PERINEURAL NERVE CATHETER IN PATIENT ROAD TO RECOVERY

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Abstract

Post surgical pain after major lower limb amputation is a major problem to the patient's recovery. The majority of patients require continuous opioid analgesics and NSAIDs after surgery, which are associated with side-effects. In order to overcome the pain encountered by these patients, we routinely practice intraoperative placement of aNerve catheter along the peripheral nerve stump. The anesthetic medication is used to calm the nerves and overcome pain perceived by the patient. We study the effectiveness of pain control and reduction in the need for oral / parenteral administration of analgesics. This step could potentially reduce post-procedure analgesics usage and other related adverse effects.

Methods: A retrospective study and data review of 98 patients who had major lower limb amputation for peripheral vascular disease over a 5-year duration. Intra-operatively, 42 patients had a perineural catheter placement were compared to 56 patients who had oral and parenteral analgesics prescribed to treat post operative pain. The primary outcomes of this studywere the number and quantity of drug needed in the first 4 days postoperatively and swiftness in postoperative recovery to do rehabilitation.

Results: 98 major lower-limb amputations were selected. Analysis shows that perineural catheter use was associated with a decreased need for postoperative analgesics and decreased postoperative pain scores at 72 hours. Perineural catheter use led to a 65% reduction inopioid + NSAIDs use during the early postoperative period. Data also suggests the patient tend to fair better in rehabilitation work with nerve catheter placement.

Conclusions: Post operative continuous infusions of local anesthetic through nerve catheter are safe and effective in reducing pain post-amputation. The analgesic medications requirement after major lower limb amputation can be significantly lowered so are the complications.

Introduction:-

Major leg amputations lead to significant problems during post-operative period. Patient suffer from disability and nearly 3/4th of patients suffer from stump pain and phantom limb pain.[1,4] Post operative Stump pain in the initial postoperative period that interferes with rehabilitation of amputees. Opioid analgesics are one of the most common agents in managing postoperative pain. The usage of these drugsare associated with significant side effects like

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delirium, nausea, and sedation. These adverse symptoms are particularly difficult in elderly population, the majority of patients undergoing lower limb amputation.[3,6] In addition, the chronic pain post-amputation is a long-term complication[5] that impairs quality of life. Regional instillation of analgesic [7,8] provide simple and effective technique to reduce acute post-surgical pain, use of opioid analgesics, and their adverse effects.

In this retrospective study, whether continuous instillation of local anesthetic infusion via a perineural stump catheter is as effective as opioids and other analgesics in alleviating pain, thus suggesting a potential for reducing post-amputation pain, opioid usage, and associated adverse effects.

Methods:-

The research study was submitted to research ethics board. On theirapproval to conduct, the hospital data of all the patients undergoing major lower limbamputation werereviewed. A total of 209 separate amputations werereviewed. Amputations due to indications not relatedto peripheral vascular disease manifestations were excluded, leaving 98 amputation cases for analysis (20 were a second primary amputation and 6 were revisions of primaryamputations).

The 98 amputations were classified into one of twogroups. The treatment/catheter group consisted of patientswho received a continuous perineural stump catheterfollowing either a below-knee amputation (BKA) or anabove-knee amputation (AKA). The second group, thecomparison group, also underwent BKA or AKA but did notreceive a perineural stump catheter. As of January 2019, thedepartment of vascular surgery began practice of using nerve stump catheters for limb amputation. Patientswere allocated to group (catheter vs. no catheter) based onthe attending surgeon availability. Each surgeon was trainedin the procedure but uptake was variable.

Patients in both groups received postoperative analgesiawith opioids that were delivered parenterally by intravenous(IV), non-PCA(e.g., oral, transdermal analgesia),or a combination of both. Patients were advised tomaintain their pain less than 4/10 (i.e., in the mild rage) and ask for analgesis when required. Patients are visited and care issues discussed dailyto optimize pain control.

On reviewing the data, following parameters were taken into account – age, sex, indication for the operation, level of amputation,preoperative pain intensity and duration, preoperative pain medication use in the 24hours prior to the amputation, and comorbidities, specificallydiabetes, smoking, and chronic pain (greater than 6months induration). Postoperative usage of analgesics during the first 72hours was documented and converted tomorphine equivalents (University of Alberta, Faculty of Medicineand Dentistry,Multidisciplinary Pain Centre;http://www.uofapain.med.ualberta.ca/en/ForHealthProfessionals/OpioidConversionGuide.aspx.

Using the described technique of Malawer, et al.,[11] at thetime of amputation, a18-gauge polyamide catheter (Portex4910-16/17) was inserted under direct vision several centimetersabove the level of transection of either the exposedsciatic (AKA) or posterior tibial nerve (BKA), depending onthe level of amputation. The catheter was then advancedcephalad 5 to 10 cm. The catheter was externalized andsecured with silk stitches. Typically, a 10-mL bolus was injected into thecatheter before wound closure to confirm patency of catheter. The wound was closed with 14 F Suction drain to prevent any collection and the drain was removed 24 hours after removal of nerve catheter. Continuous infusion of local anesthetic was commencedin the recovery room.

Placement of the perineural stump catheters that supplied a continuous infusion of bupivacaine (0.125%, 4 mL/hour), or lidocaine (1%, 8 mL/hour); 90% of catheters delivered bupivacaine (0.125%).

Postoperative patient-reported pain intensity scores during the first 24 hours were recorded on an 11-point numeric rating scale (NRS) (0 is “no pain”, 10 being the “worst pain imaginable”). Finally, duration of the perineural catheter placement, duration of hospital stay postoperatively, time to mobilization, and presence of delirium (delirium was assessed by the Confusion Assessment Method), sedation, and nausea were also measured.

Results:-

Descriptive statistics

A total of 209 separate amputations were reviewed. Amputations due to indications not related to peripheral vascular disease manifestations were excluded, leaving 98 amputation cases for analysis (20 were a second primary amputation and 6 were revisions of primary amputations)for peripheral vascular disease, with an average age of

around 68 years. Few variables are presented under Demographics, comorbidities, and perioperative factors are presented in Table 1. The differences between the catheter and non-catheter groups in gender, age, previous chronic pain, smoking status, diabetes status, preoperative pain scores, preoperative 24-hour opioid, or above knee vs. below knee assignment in surgery are not significant.

	Catheter (n = 52)	Non catheter (n = 46)
Gender	Male 36 Female 16	Male 32 Female 14
Mean Age	69.8	66.7
Previous history of pain duration in days	42	32
Diabetes	37	35
Hypertension	27	24
Cardio/cerebro vascular disease	14	13
Chronic kidney disease	12	10
Smoking	46	40
Mean preoperative pain score	5.1	4.8
Mean preop 24 hours opioid usage(SD)	20.1	18.9
Level of Amputations	AKA 32 BKA 20	AKA 28 BKA 18

Table 1:- Demographic and presurgical variables.

Pain medications use

The use of analgesic medications was converted to morphine equivalents. Stump catheter use was associated with a significantly lower total postoperative opioid use (catheter vs. non-catheter). Perineural catheter use were associated with significantly less total opioid use in the first 72 hours postoperatively. A significant predictor of lower total post-surgical opioid use found to be the perineural catheter usage. There was a decrease in total opioid with increased age, while preoperative opioid use, PCA use, and preoperative chronic pain were all associated with an increase in total opioid use.

Table 2:- Opioid usage in milligramsMean (SD) during first 72 hour post-surgery.

	Catheter	Non catheter
Initial 24 hours	29.2	52.1
24 to 48 hours	24.7	48.3
48 to 72 hours	22.1	37.9
Total usage	76.0	138.3

Postoperative pain

Postoperatively, no difference between the catheter and non-catheter groups in total pain after amputation. In both groups the average 24-hour postoperative pain intensity was low (catheter 2 to 3 vs. non-catheter 3 to 3.5).

Above-knee versus below-knee amputations

There wasa equal ratio of AKA and BKA cases in both groups. No significant difference in the amount of opioid used between patients who had AKA and BKA postoperatively. Pain levels were significantly lower for AKAs than BKAs (AKA 2 to 3 vs. BKA 3 to 5).

Mobilization after amputation

The number of days to sit up in bed (catheter 1.5 to 2.5 days vs. non-catheter 3.5 to 5 days) or to mobilize out of bed within 3 days after amputation (catheter 60% [32 of 52] vs. non-catheter 20.00% [9 of 46]) were significantly different between the groups. The patients with catheter felt more motivated to mobilise early.

Adverse events

Delirium

The results revealed a trend for decreased incidence of delirium levels in the catheter group and increased days of recovery and turbulence in the non catheter group.

Sedation and nausea.
The occurrence of sedation (catheter 3 patients vs. non-catheter 5 patients) and nausea (catheter 1 vs. non-catheter 1) were very low.

Catheter failure
Perineural catheters remained in place for an average of 2.5 to 3 days. Three catheters failed, Two became blocked, one was disconnected by the patient. Although failure occurred in 3 of 52 catheter inserted group, there was remarkable difference in the average time to discharge from the hospital to home based rehabilitation following amputation (catheter 7 days vs. non-catheter 13 days).

Deaths.
There were six deaths in-hospital (catheter 3; non-catheter 3). No significant differences in the number of deaths based on catheter status during follow up.

Discussion:-

This retrospective chart review of 98 consecutive amputationsshowed that continuous infusion of local anestheticvia perineural catheters is an effective tool to reduce opioidanalgesic consumption following lower limb amputation. Inthe present study, although postoperative pain was wellmanaged in both groups a significant between-group differencein pain scores did not emerge. The use of perineuralcatheters provided equivalent postoperative pain controlrelative to the comparison group with significantly lessopioid usage.

Previously, it has been reported that perineural analgesiaat the surgical site is a safe and effective method that leadsto a significant reduction in postoperative opioid consumptionfor patients undergoing various surgeries.[3,12-17]Several previous studies have examined the use of perineuralcatheters to control postoperative amputation painbut have produced varied results with small samplesizes.[3,14,16,18-21]This current study is the largest evaluation of perineuralinfusion catheters following lower limb amputations in Indian population. Ourresults indicate that the use of perineural infusion catheterseffectively reduces post-amputation consumption of opioidanalgesics with comparable pain scores up to 24 hours. Theability to reduce opioid consumption after amputation butto still maintain adequate pain control is particularlyimportant for patients of advanced age who may be moresusceptible to the side-effects of opioids.3 Although weinvestigated whether there was a decrease in deliriumfollowing lower limb amputation with perineural catheteruse, this study was underpowered to have found it. Perineuralcatheter use was found to be safe and failure rateswere low without an increase in adverse events, which is inline with previous studies.[3,14,16,18-20]

In addition to the side effects of opioid analgesics, postamputationpains are a significant problem for patientsrecovering from lower limb amputations. We were unableto find any differences in the patient-reported pain scoresbetween the comparison group and the catheter group.Patients in both groups had their pain very well controlledwhile in hospital.[20]The low levels of postoperative pain ineach group support this conclusion. In studies where pain iswell controlled, the level of pain medications required bypatients may be a better means to assess the efficacy ofanalgesic regimens such as perineural catheters. Importantly,we noted no differences between AKA and BKAgroups in their levels of postoperative opioid use.There are several limitations to this study. First, given theretrospective nature of the data collected, adequate standardizationof postoperative care cannot be assured. Second,there may be a surgeon bias to provide patients withhigher morbidity a perineural catheter. Third, due to thevariability in the data and small-to-moderate sample size,confidence intervals in the analyses were large. Finally, paindata were not available beyond 24 hours after patientswere discharged from the APS.In this report we did not address whether perineuralstump catheters are able to reduce phantom limb painsafter amputation. Previous reports after lower limb amputationhave suggested that perineural catheters may beeffective in reducing phantom limb pains.[3,14,19] However,phantom limb pain is a complex phenomenon that likelydevelops due to a combination of pre-amputation pain[1,22e24] as well as the transection of nerves at the time of surgery,and ectopic activity from the transected fibers after surgery.[25] Based on the results presented here a large randomized,double-blinded study with clear endpoints shouldbe implemented. A prospective study would enable investigationinto the possibility of effectively lowering rates ofstump and phantom limb pains.[3,14,25e27]In conclusion, continuous perineural catheter infusions oflocal anesthetic are a safe and effective method forreducing opioid analgesic medications following lower limbamputations.

Conflict Of Interest
None.

Funding
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