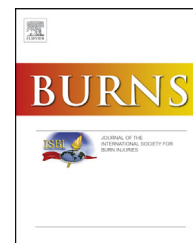


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Post-operative pain control for burn reconstructive surgery in a resource-restricted country with subcutaneous infusion of local anesthetics through a soaker catheter to the surgical site: Preliminary results

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ABSTRACT

Objective: Post-operative pain can significantly affect a patient's ability to recover following surgery. In this study we introduced the concept of post-operative pain evaluation of burn patients as well as a technique for placement and use of subcutaneous catheters for continuous infusion of local anesthetic to provide analgesia following skin harvest from the lateral thigh in a hospital in resource-restricted country - Ukraine.

Methods: A total of 109 patients were enrolled in this study. In the control group 64 patients received the standard post-operative pain regimen of metamizole 1 g and/or ketorolac 3%-30 mg at the discretion of the nursing staff. In the interventional group, 45 patients received the catheter infusion of local anesthetic by elastomeric pump which was placed intraoperatively; it continuously delivers a regulated flow 4–5 ml/h of procaine 0.5% for 48 h to a patient's surgical donor site with the standard pain regimen available for breakthrough pain. All patients were assessed post-operatively and in the peri-dressing change period by the nursing staff. Blood pressure, heart rate, and pain scores were documented based on the Wong-Baker Faces Pain Rating Scale. All data were analyzed using SAS version 9.3. The Student's t test and Fisher's exact test were used to assess differences between groups for continuous variables. The Mann-Whitney U Test was used to examine differences in pain scores between groups. A p value of <0.05 was considered significant.

Results: The median pain score immediately following surgery was 5.0 in the control group, which was significantly greater ($p = 0.03$) than median pain score of 4.0 for the patients receiving continuous infusion of procaine. However, there is no statistically significant difference in the median pain score (3.0 and 3.0) after the initial dressing change ($p = 0.73$).

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Conclusions: Our Ukrainian colleagues now have a method of objective pain assessment and a new technique in pain management. With assessment linked to intervention, improvement in post-operative pain can be expected.

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1. Introduction

Advanced procedures for pain management including epidural catheters, single shot regional block procedures and continuous peripheral nerve catheter placement have been successful at improving post-operative analgesia. The review by Liu et al. focused on the use of catheters in linear surgical incision type wounds rather than wounds with a large raw area, such as skin donor sites [1–3]. Consequently, physicians began introducing a catheter directly into a wound at the end of surgery to provide continuous post-operative local infusion and therefore analgesia [4]. A systematic review by Liu et al. examined the literature regarding continuous wound catheters delivering a local anesthetic in which no specific peripheral nerve was targeted [4]. This review clearly identified benefits to continuous infusion wound catheters including decreased mean pain scores at rest and with activity and decreased opioid use and side effects.

Acute post-operative pain can significantly affect a patient's recovery both physically and mentally as well as contribute to increased costs associated with patient care [5,6]. In addition, patients with poor post-operative pain management are at greater risk for prolonged hospitalization, pneumonia, tachycardia, poor wound healing, nausea and vomiting, transition to chronic pain, and drowsiness, all of which increase health care costs [7–9].

Split thickness skin grafts (STSG) have become a common procedure for harvesting skin in burn patients for auto transplantation. It is well documented, that patients have more pain at the STSG donor site, than the grafted site [10]. Several methods have been assessed in the literature to evaluate pain control options in STSG donor sites. These include topical application of ice; topical application of lidocaine; alterations in surgical methods for split thickness skin graft harvesting; novel dressing materials, and peripheral nerve blocks (single shot or continuous catheter placement) at the lateral femoral cutaneous nerve [10–18]. All techniques have had minor successes, however not without flaws. Topical application of ice in addition to local anesthetic had a limited time benefit, and new harvesting techniques and novel dressing materials provided minimal benefit with patients requiring continued high doses of opioids for analgesia. Peripheral nerve blocks, especially with catheter placement provided excellent analgesia; however, it required a skilled healthcare provider to place and also limited the graft area site, a problem when large areas are required for harvesting [10–18].

A novel approach by Reguero Hernandez et al. reported a case series of 9 patients requiring STSG in which wound catheters were placed intra-operatively for continuous infusion of local anesthetic. Patients were followed for STSG donor site pain using the Wisconsin Brief Pain Inventory (short form)

and identified a significant decrease in worst, least, and average donor site pain from the first 24 h through the second post-operative day. Unfortunately, this case series is limited and does not assess the level of pain control compared to the standard of care therapy [19].

Ukraine, a newly sovereign nation in Eastern Europe, has a population of greater than 44 million people [20]. Given its newly acquired independence and loss of Soviet infrastructure and funding, medical treatments have suffered. Subsequent to stringent Soviet era restrictions and a novel government fighting the illegal use and abuse of narcotics, Ukraine limits access to opioid medications for analgesia. According to a report by the United Nations titled, "Report of the board on the availability of controlled substances" Ukraine ranks 41st of 42 nations included in the study in regard to availability of opioids [21]. In Ukraine, it has been reported that opioid medications are used intra-operatively and in the intensive care units and are not available as intramuscular injections, intravascular injections, or even as oral medications on the ward or for ambulatory patients. Opioid medications are not freely available [22,23]. Ukraine is in a unique position to benefit greatly from the local infusion technique described by Reguero Hernandez et al. We have worked closely with the Ukrainian government and have established an outreach program with an annual medical education outreach to Ukraine to help local physicians [24]. Through this program we observed absence of pain evaluation, limited nursing availability, and restricted opioid use.

An objective was to initiate the concept of post-operative pain evaluation in burn patients in resource-restricted environment (Ukraine) and to introduce the technique for placement and use of subcutaneous catheters for continuous infusion of local anesthetic to provide analgesia.

2. Material and methods

2.1. Design and setting

This is a prospective controlled study conducted at Municipal Hospital #8, Lviv, Ukraine between November 2013 and April 2014. IRB approval (Protocol #: 2012P002299) was obtained through Partners Health Care in Boston, Massachusetts, FDAAA trial registry approval was obtained (NCT01863940) and protocol approval was obtained by the Municipal Hospital in Ukraine.

2.2. Inclusion and exclusion criteria

Two hundred consecutive patients aged 12–65 scheduled for reconstructive plastic surgery with split thickness skin grafts from the lateral thigh were considered to participate. Patients

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