The effect of regional block over pain levels during vacuum-assisted wound closure

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Abstract

Despite being a wound treatment method with a broad spectrum of indications, vacuum-assisted wound closure (VAWC) can be a painful treatment modality which may even result in patient unwillingness for the continuation of treatment. A prospective study was undertaken to determine the effect of regional pain blocks (RPB) for patients who wanted to abandon treatment due to pain after the first application. Patients were asked to score their pain using a visual analogue scale for two different time frames (i) during dressing changes and (ii) while daytime treatment. This evaluation was carried out for conventional wound dressings, VAWC before RPB and finally for VAWC after RPB. The pain experienced with blocks was significantly lesser than conventional and VAWC dressing changes that were applied without pain blocks. Also, the pain was significantly lesser under pain blocks for daytime treatment. For patients with refractory pain where VAWC would prove to be of most benefit, RPB can be discussed with the patient and used. This study has shown that effective pain control can be obtained through regional blocks for patients with excruciating pain undergoing VAWC treatment.

Key Messages

• Pain occurring during vacuum-assisted wound closure application may be a reason of unwillingness for the continuation of treatment
• Regional pain blocks may help to continue treatment in such limited cases

The purpose of this study was to compare the levels of pain before and after the use of regional pain blocks (RPB) for patients who wanted to abandon VAWC treatments because of pain after the first application. In light of the results, the study also discusses the efficiency of regional anaesthesia by controlling pain without jeopardising the effects of VAWC.

Materials and methods

This prospective study was undertaken between 2005 and 2008 on 15 patients undergoing intermittent −125 mmHg negative pressure (5 minutes on/2 minutes off) VAWC. Having refused to continue treatment due to pain intolerance after the...
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first application, these patients were given RPB after being fully informed about the procedure and providing written consent. All patients had wound closure with polyurethane (black) foam before the RPB and continued closure with the same dressing post-block.

Patients’ information regarding age, gender, the aetiology of the wound, location, size and duration were all noted. Wound duration shorter than 3 months was classified as acute, whereas wounds with a longer duration period were classified as chronic wounds. Data were also gathered regarding the total time of VAWC therapy, total time of RPB application, the need for analgesic medication before VAWC therapy and before RPB and the type of surgery performed for the final closure of the wound.

All patients had received at least one same conventional wound dressing before VAWC (betadine cleansing and gauze pad dressing). A visual analogue scale (VAS) was used for the evaluation of pain. Pain scores were assessed according to a 0–10 numeric pain scale. Patients were directed on the use of the VAS before receiving RPB. All patients were asked to evaluate their pain levels before and after VAWC therapy for two different time frames (i) during dressing changes and (ii) while daytime treatment. Patients were asked to repeat the same pain assessment regarding VAWC therapy and dressing changes after RPB were performed.

Patients were administered 10 ml of 0.125% bupivacaine in bolus form four times a day through a continuous catheter. VAWC dressing changes were performed every 48 hours, 30 minutes after the administration of bolus bupivacaine. Patients were not given any other oral or parenteral form of analgesic as they did not require it.

For statistical analysis, the descriptive statistical parameters; Pearson $\chi^2$ test, Fisher’s exact test, Wilcoxon signed-rank test, Friedman variance analysis and Spearman correlation test were used. Demographic data were presented as median (interquartile range), and other parameters were presented as mean ± standard deviation and frequency range percentages. Statistical significance was set at a level of $P < 0.05$.

Results

Of the patients enrolled in the study, six (40%) were women and nine (60%) were men. The median age was 52 (interquartile range: 32–64) years. The location of the wounds that were treated with VAWC was as follows: three on the upper extremity (hand and forearm), nine on the lower extremity (heel, shin, and thigh) and three on the abdomen. In other words, 80% of wounds were located on the extremities whereas 20% were located on the abdomen. Thirteen (87%) wounds were classified as acute whereas two (13%) were chronic wounds. Eighty percent of patients used analgesics during conventional wound dressings before VAWC and the percentage went up to 100% with the use of VAWC. The median duration between the start of the wound to the initiation of VAWC treatment was 10 (interquartile range: 8–22) days. Patients underwent an average of 16 (interquartile range: 14–21) days of VAWC treatment. The average duration of RPB was 5 (interquartile range: 4–7) days. Six patients received epidural, three received axillary and the other six received popliteal catheters for regional pain blockade. This duration was shorter for epidural catheters and a little longer for peripheral blocks. The median wound dimension was determined as 81 (interquartile range: 36–150) cm$^2$. VAS scores were noted for three different methods (i) during conventional dressings, (ii) after starting VAWC before receiving RPB and (iii) after RPB. Pain scores gathered for both ‘during treatment’ (while the device is working) and ‘during dressing changes’ are presented in Table 1. The comparison of pain scores between the time of dressing change and daytime treatment demonstrated significant difference ($P < 0.01$). When the three different methods were compared (conventional dressing, VAWC before block and VAWC after block) to one another, the difference among each was also statistically significant.

According to the data, least pain was reported under RPB, and pain during conventional dressing changes was significantly higher than that experienced with RPB. Pain during dressing changes for patients with VAWC before RPB was significantly higher than the two other methods (Figure 1). The same order was observed for pain scores during daytime treatment and the difference was statistically significant for all the three methods ($P < 0.01$). Least pain was reported under RPB, followed by conventional dressings whereas pain levels during daytime treatment of patients with VAWC before block were reported to be much higher (Figure 2).

No local or general complications were encountered regarding regional blocks such as pressure ulcer formation (especially for epidurals), local anaesthetic toxicity, infection at the catheter site, nerve injury and hypotension. Following VAWC therapy, closure was achieved with split-thickness skin grafting in nine wounds and local tissue flaps in six wounds.

Table 1. The comparison of pain scores between the time of VAWC therapy and dressing changes after RPB were performed.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Conventional dressing</th>
<th>VAWC before block</th>
<th>VAWC after block</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dressing change</td>
<td>3.8 ± 0.7</td>
<td>7.9 ± 0.7</td>
<td>2.7 ± 0.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Daytime treatment</td>
<td>1.8 ± 0.6</td>
<td>5.7 ± 0.7</td>
<td>1.3 ± 0.5</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

VAWC, vacuum-assisted wound closure; VAS, visual analogue scale.

*Data is shown as mean ± standard deviation. Friedman variance analysis showed statistical difference in pain scores for all three settings. Wilcoxon signed-rank test was used to determine the setting that generated this result which showed that the difference was statistically significant for each of the three methods.

Discussion

Besides its use for some large acute wounds, VAWC particularly has become a treatment of choice because of
its contribution to preparing hard-to-treat chronic wounds for surgery. Although not crucial, its effect on reducing oedema, increasing the wound contraction rate and providing fast and healthy granulation tissue to the wound bed are among its most desirable treatment goals (1–3). Another favourable advantage it yields over conventional dressings is the need for fewer dressing changes. Even though the moist environment VAWC provides may appear to alleviate pain during dressing changes, the migration of granulation tissue into the foam results in a high level of pain during its removal (4,5). The negative pressure creates a force that contracts the wound edges towards the centre which also may cause a great deal of pain for a group of patients especially in the first few days of treatment (1,2,6,7).

As with all medical treatments, it is crucial to maintain the patients’ comfort and therefore substantially control pain. Anxiety caused by pain can also lead to the patient’s abandonment of the treatment. Therefore pain control is an ethical responsibility of the physician. For this clinical situation, the first solution is to supplement the patient with oral and parenteral analgesics. Yet patients with systemic diseases such as diabetes mellitus may have underlying conditions in which high doses of analgesics must be used with caution (8). Nonsteroidal anti-inflammatory drugs (NSAIDs) are usually insufficient for controlling this type of pain. Opiates on the other hand have substantial side effects varying from nausea to respiratory depression. Difficulty in dose adjustment, not to mention their potential for addiction and tolerance are also among the reasons that opiates are not favoured for using in clinical settings unless absolutely necessary. Other approaches that have been used to reduce wound pain include lidocaine patches and clonidine patches.

The solution proposed for pain, refractory to analgesics is lowering the negative pressure levels (1,2,4). Yet even though this manoeuvre may reduce pain during daytime treatment, its effect on alleviating pain during foam elevation in dressing changes is quite low. There are also literature studies debating that negative pressure levels less than 125 mmHg reduce the clinical benefit and also increase the duration of treatment (1,2,9). Even then, there are studies arguing that efficient treatment can be achieved with negative pressure levels between 50 and 150 mmHg (1,2,10,11). Theoretically, with less negative pressure levels oedema resolution is expected to be a slower process. This delay may result in a longer state of poor wound perfusion because of the impact of tissue oedema on lymphatics and vasculature. This explains the reason behind treatment guidelines that state the importance of continuous negative pressure for the first 2 days of treatment (12).

Pain control during dressing changes can be obtained by using gauze or polyvinyl alcohol (white) foam that appear to adhere less to the wound bed (1,2,5,7,13,14). But studies show that better granulation formation is achieved through treatment with black foam (1,2).
cavitary wounds. There are studies that demonstrate no significant difference between using gauze or foam, but these studies are mostly based on foam closure and there is no general consensus regarding the subject. Even then, as a clinical observation, regardless of the closure material used, some patients experience pain during treatment and dressing changes more than others. Wound characteristics contribute to this situation along with a lower threshold for pain.

In a study reported by Franczyk et al., (15) patients were given lidocaine through the closure tubing 30 minutes prior to dressing change. This resulted with a significant reduction in pain levels. Although this method seems to be quite logical, it ceases to be a solution for pain during the application of negative pressure. The risk of contamination with retrograde administration of a solution and waiting 30 minutes must also be taken into consideration, especially for wounds that are located near the abdomen and thorax.

In contrast, successful results can be achieved with lower doses of local anaesthetics when used with regional blocks. These applications have limited general side effects but even then, precaution must be taken to avoid local complications. Dose regulation can be obtained through patient-controlled pumps. This was not used for patients within the study but we later experienced that giving patients control over their own pain was quite comforting and beneficial for pain control.

Within our study, we used RPB for patients who wanted to abandon VAWC treatment after the first dressing change despite using analgesics and lowering negative pressure levels. Ideal intermittent negative pressure (125 mmHg) was applied to all patients after regional block was achieved. Pain levels were significantly lower and all patients completed their treatments with comfort. As RPB did not cause motor deficiency with the given doses (10 ml of 0.125% bupivacaine in bolus form four times a day), patients were able to ambulate according to their daily needs. It is also known that peripheral blocks located on the extremity decrease sympathetic innervations and thereby allow vasodilation that can increase blood flow and promote wound healing.

Although RPB is an invasive procedure, the use of nerve stimulators and adhering to antisepsis rules decreases complications such as nerve damage and infection. Also, ultrasound guided nerve blocks would now be considered the appropriate standard of care. Additionally, patients rarely need this procedure throughout the entire treatment. Patients’ pain thresholds increase as treatment is continued and therefore pain control within the first few days of treatment is quite beneficial for patient adaptation. Pain control can be maintained through analgesics in the later days of treatment.

Standardising pain and wounds for clinical studies poses quite a challenge. Even though wounds generate by similar causes, underlying differences for patients can cause different clinical courses. Personal pain thresholds are also quite different from patient to patient. Therefore, it is challenging to undertake a prospective randomised controlled study when dealing with pain and wounds. Yet within the study, the same patients compared pain levels for the same wounds for three different settings. We believe this has a positive influence for standardisation in this study. The fact that these patients wanted to abandon treatment because of pain serves as a basis to show that RPB are effective in alleviating refractory pain.

In conclusion, the first solution for pain control in patients undergoing VAWC should be oral and parenteral analgesics, followed by decreasing negative pressure levels. But for patients with refractory pain where VAWC would prove to be of most benefit, RPB can be discussed with the patient and used. This study has shown that effective pain control can be obtained through regional blocks for patients with excruciating pain undergoing VAWC treatment. Blocks increase the comfort of the patient without having to reduce the negative pressure thereby not jeopardising clinical benefit and also provide an increase in regional blood flow by sympathetic block. It has been shown that VAWC is cost-effective as it lowers hospital stay (1,2,16). No data on cost are provided in this study. But it may be a subject for another study which will research the contribution of the pain blocks to cost-effectiveness in the treatment of wounds.

References


