

# Lavage drain extension for local anaesthetic instillation into abdominal wounds

ALAN D. WIDGEROW, M.B. B.CH., F.C.S. (S.A.), M.MED., F.A.C.S.

CRAIG WITTSTOCK, M.B. B.CH.

GEOFFREY P. CANDY, PH.D.

Department of Surgery, University of the Witwatersrand and Netcare Linksfield Park Clinic, Johannesburg

## Summary

*Background.* A new device made by ThebeMedicare allows efficient local anaesthetic washout of wound areas, by utilising an attachment to an existing drain. The aim of this trial was to explore 'proof of concept' in patients undergoing abdominoplasty procedures.

*Patients and methods.* Thirty-one patients who had undergone abdominoplasty procedures were selected for instillation of a local anaesthetic preparation, ropivacaine (Naropin, AstraZeneca) into the wound site on day 1 and 2 after surgery, followed by early mobilisation. Efficacy of the system, patient comfort and mobilisation were documented.

*Results.* The abdominoplasty patients experienced no discomfort from the procedure and claimed effective relief of pain for an average of 12 hours following instillation of local anaesthetic. All mobilised effectively. The device worked well, with no technical problems.

*Conclusion.* The lavage drain extension has proved to be a cost-effective and efficient way of providing postoperative pain control and promoting early mobilisation in this patient group.

Postoperative pain control in abdominoplasty plays an important role in early prevention of complications – it promotes early mobilisation and is likely to shorten hospital stay. Various pain pumps for expediting postoperative pain control have recently come onto the market.<sup>1-7</sup> These pumps distribute a constant small flow of local anaesthetic (LA) to the operation site via an indwelling catheter. Recent publications have questioned their efficacy in relation to the target area and distribution of the LA, and have criticised the cost of such devices.<sup>1,3</sup> We successfully utilised a lavage drain extension that fits onto the drain, to maintain sterility and flush out the wound site with LA, providing 12 hours of analgesia and promoting early mobilisation, in an extremely cost-effective manner.

Closed drainage systems have been used in a variety of surgical procedures for many years and have proved successful in terms of effective drainage of an operation site, with minimal risk of sepsis. The addition of a lavage device to the drainage system allows washout of the operation site or instillation of therapeutic agents.

The device made by ThebeMedicare can easily be adapted to the existing Surgivac (ThebeMedicare) and PortoVac, Blake, Jackson Pratt and other drains generally used. The device is easy to use, ensures no violation of sterility, is relatively inexpensive, and adds minimal cost to the operative procedure.

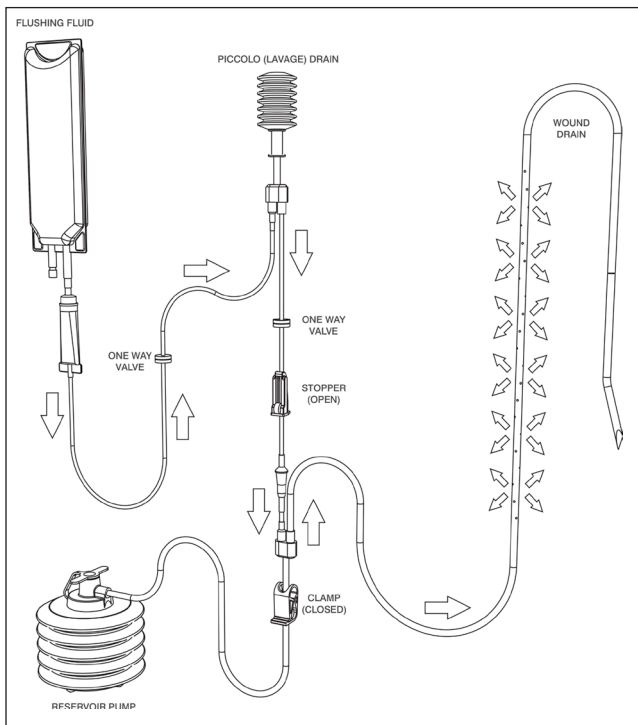
## Methods

In order to test 'proof of concept', 31 patients who had undergone abdominoplasty procedures were selected. Lavage drain washout with ropivacaine (Naropin (AstraZeneca) polybag 100 ml, 2 mg/ml) was undertaken on day 1 and 2 following surgery (24 hours apart, timed with anticipated mobilisation periods). The full 100 ml was instilled into the operation site over 1 - 2 minutes in all patients. No adrenaline or any other agent was added to the LA. The aim was to reduce pain and encourage early mobilisation following surgery. Full documentation of all steps of the process was undertaken. Patients were assessed according to their final wound healing, and questioned about the ease or difficulty of the lavage process, analgesia and ease of mobilisation, by means of a questionnaire. The questionnaire was detailed regarding comfort of the lavage process, side-effects of the instillation and the analgesia that followed. Pain investigation was directed at pain that directly inhibited mobilisation, rather than a detailed description of the nature of the pain. Below is an example of one of the questions asked in this connection:

Circle a number to indicate how much your pain has **interfered with your ability to walk after local anaesthetic washout.**

0	1	2	3	4	5	6	7	8	9	10
None	Mild		Moderate			Severe		Completely		

All patients had calf pumps applied for the duration of surgery and until mobilisation was started. No further deep-vein thrombosis prophylaxis was given. Historical experience (of the senior author – Professor Widgerow) relating to pain experience, ease and extent of mobilisation, and duration of hospital stay was used as a control. Informed consent and ethics approval were obtained.



**Fig. 1. Lavage drain design.**

The apparatus consists of an extension set connecting to an existing drain device (Fig.1). The set consists of a lavage pump (piccolo drain), one side of which connects to a fluid administration set and flushing fluid, and the other side to the existing drain. One-way valves are located before and after the lavage pump to prevent backflow of fluid or effluent.

Clamps or stopper controls are in every line to control the flow of fluid in the desired direction. The mechanism ensures that fluid from the wound site drains into the drain reservoir and does not enter the lavage system.

The lavage system works by compression of the piccolo pump, which has filled with flushing fluid from the fluid bag. This compression causes flushing fluid with or without added agents to enter the wound through the wound drain. At the same time, the clamp is closed between the drain and the reservoir, ensuring unidirectional flow of flushing fluid into the wound.

Once adequate fluid has been instilled, the clamp to the reservoir remains closed for half an hour, allowing the wound area to bathe in the LA fluid. Thereafter, the drain is unclamped and drainage commences normally. After the second instillation or when final lavage is completed, the tube is cut off proximally to the closed stopper, and this remains as a short attachment to the drain should the patient be sent home with the drain.

## Results

The apparatus worked efficiently in all cases. The lavage/piccolo pump was most effective at boosting the flow of lavage fluid. The system was not dependent on the pump but was made significantly more efficient by its use.

The 31 patients treated in the abdominoplasty group experienced approximately 12 hours (significant deviation (SD) 1.5 hours) of pain relief. According to questionnaire responses, pain relief was effective and long-lasting. This related especially to muscle tightening and to pain inside

the abdomen. Twenty-three patients (74%) reported feeling tightness of the skin and having to walk slightly hunched for the first 3 - 6 days, but this did not interfere with mobilisation, and differed from the tight muscular pain and internal pain often complained about by patients undergoing routine abdominoplasty procedures without LA flushing. The first 6 patients experienced a small leakage of fluid around the drain site during instillation; this was solved by stitching the drain in place in the subsequent 25 patients, which prevented leakage past the drain. Otherwise, no complaints were expressed about the procedure, instillation or mobilisation, and all 31 patients mobilised efficiently from day 1 following surgery. No other complications were experienced with the lavage process.

On the pain/mobilisation scale, 70% (22/31) of patients graded themselves as 1 - 2, i.e. experiencing mild impedance of mobilisation due to pain. The remaining 30% (9/31) graded their pain as less than 5 (less than moderate impedance) on the scale. No patients complained of severe or complete inability to mobilise because of pain. This finding was in direct contrast to the historical perspective where most patients complained of inability or unwillingness to mobilise because of pain (5 - 8 on the pain scale). This was the primary indication for initiating the lavage system.

All patients noted that they would recommend its use following this type of surgery.

From a historical perspective over the past 20 years, a major problem with abdominoplasty patients has been their reluctance to mobilise early, primarily because of the pain associated with rectus muscle plication. Patients were routinely hospitalised for 2 - 3 days following surgery; postoperative analgesia involved the use of pethidine immediately after surgery and then 6-hourly for the first day after surgery, together with oral analgesics (Synap Forte). Historically, the regimen followed in abdominoplasty patients was 1 dose of pethidine immediately following surgery, and 2 more doses during the recovery period in hospital. Hospital stay was 3 days.

Of the 31 patients in this trial, none stayed in hospital longer than 2 days after surgery. This was routinely adhered to, as the second lavage was performed on the second day. No patient asked to remain in hospital longer. It is possible that if the lavage is started immediately after surgery (day 0) and repeated on day 1, many patients may shorten their hospital stay even further. Pethidine was routinely administered immediately after surgery. Of the 31 patients in the trial, 64.5% (20/31) had no further doses, 19.3% (6/31) had 1 more dose of pethidine, and 5 patients had 2 further doses of pethidine. These latter cases had combined surgeries (breast reductions). In brief, the majority of patients (84%) used significantly less postoperative analgesia than the historical norm, and potentially were able to leave hospital earlier.

## Discussion

Closed drainage systems continue to be used routinely in many surgical procedures. The lavage drain addition was designed to provide analgesia to the wound site in a sterile environment utilising a simple, cost-effective device.

The method described in this study provided good pain control and permitted early mobilisation. This may also be applicable after laparotomy and would probably have the same effects in other areas (herniorrhaphies, pelvic,

orthopaedic surgery, etc.)<sup>6,7</sup> and other plastic surgery procedures where pain pumps have been used, including flap reconstructions, donor sites, breast augmentations and the like.<sup>1-5</sup> Our good results contrast strongly with recent criticism levelled against pain pumps<sup>3</sup> – technical aspects such as location and placement of pain pumps, and routine placement of closed suction drains inferior to the catheters of the pump, alter their efficacy in abdominoplasty. These facts, in addition to the extremely high equipment prices, mitigated against their use. In contrast, the lavage drain delivers anaesthetic to the precise location where it is needed, works well in conjunction with closed suction drainage, involves 1 or 2 instillations rather than continuous infusions, and costs a fraction of the pain pump apparatus. This cost is also more than compensated for by reduced postoperative intravenous analgesia, and the potential for shortened hospital stay.

The reason for using ropivacaine rather than bupivacaine, which has been used in other trials, was the need for a long-acting LA which is less cardiotoxic than bupivacaine.<sup>8,9</sup> Several experimental and clinical studies confirm ropivacaine's lower and different toxicity profile compared with bupivacaine.<sup>10-14</sup> Ropivacaine provides an approximately 10% shorter duration of analgesia and a 20% shorter motor block than bupivacaine. Clinical studies show that epidural infusion of ropivacaine 2 mg/ml can provide adequate pain relief up to 72 hours after major abdominal surgery.<sup>14</sup>

Following this trial, 3 patients underwent LA washout following abdominoplasty, but these patients received their first washouts immediately after the procedure (day 0), while still on the table. The washout is carried out with the drain clamped for half-an-hour as previously described. The following day (day 1), the instillation was repeated and mobilisation started. As anticipated, it appeared that this variation had the added advantage of immediate postoperative analgesia and avoidance of the pain cycle. All 3 of these patients were discharged the day after surgery. Subsequent experience may persuade us to adopt this technique in all cases.

In addition to the LA advantages, the lavage set could provide the following benefits and applications:

1. Simple washout of the operation site before removal of the drain, aiding the elimination of unwanted products and diminishing the potential for bruising.

2. Evacuation of haematomas or collections of blood resulting from generalised ooze with the potential to avoid return to theatre in some cases.

3. Ability to instil therapeutic agents into the cavity to the exact areas where they are needed. These agents can be antibiotics (septic abdomen, hand tendons – tenosynovitis, joints, etc.), steroids (breast implant capsules, abdominal adhesions), tissue adhesives or sclerosants (donor site seroma

areas – latissimus dorsi, mastectomy sites, etc.), haemostatic agents (large raw cavities in patients prone to bleeding) and the like. These agents can be given at periodic intervals during the drain lifetime or just before removal of the drain.

4. Dilution of potentially toxic substances secreted in cavities in certain operation sites (pancreatic fistulas, oncological agent tissue infiltration).

The purpose of this trial, and the most obvious advantage demonstrated at this stage, is that of pain control by periodic instillation of LAs and the excellent potential for early mobilisation.

## Conclusion

The new lavage drain device made by ThebeMedicare for use in conjunction with various surgical procedures has proven to be safe and effective in the abdominoplasty trial described in this report. New applications are likely to emerge as use of the device continues.

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