Preclosure bolus administration
• The study used 20 mL bupivacaine 0.5%, or 2 mg/kg body weight, if body weight < 50 kg.

Expert opinion
A preclosure bolus infiltration is suggested, but has not been evaluated so far. However, patients receiving PCSSA pumps on a routine basis might not benefit as much from a preclosure bolus.
Evidence grade: Low

Drug and dosing regimen
• Intermittent wound irrigation with 20 mL syringes of bupivacaine 0.5% or 2 mg/kg body weight, if body weight < 50 kg.

Expert opinion
Bupivacaine was effective in other studies and is therefore suggested. Whether the dosing regimen contributed to the negative effect in this study remains unclear.
Evidence grade: Low

Duration of infusion
• Irrigation was performed every 4 h within the first 24 h with one postoperative bolus, followed by a further six doses.

Expert opinion
Whether duration of infusion contributed to the negative effect in this study remains unclear. Duration should be tailored to the patient’s needs.
Evidence grade: Very low

Practical details for breast augmentation
Elective cosmetic breast augmentation
(Rawal et al. 2006)
Bilateral breast augmentation
(Kazmier et al. 2008)

Catheter type
• A multiholed catheter was used in one study (Rawal et al. 2006). The other study did not specify the type of catheter used (Kazmier et al. 2008).
Expert opinion
Multiholed catheters have been shown to be effective and are suggested.
Evidence grade: Moderate

Catheter placement
• In one study, the catheter was placed subcutaneously through an incision along the periphery of each breast (Rawal et al. 2006). In the other, the catheter was placed in the dissected pockets at the lateral sulcus and tucked along the superior sulcus (Kazmier et al. 2008).

Expert opinion
Subcutaneous catheter placement is suggested.
Evidence grade: Moderate

Preclosure bolus administration
• Not used.

Expert opinion
A preclosure bolus infiltration is suggested, but has not been evaluated so far in this setting.
Evidence grade: Very low

Drug and dosing regimen
• In one study (Rawal et al. 2006), intermittent bolus with up to 10 doses of 10 mL ropivacaine 0.25% into the left breast and/or 10 mL of ropivacaine 0.5% into the right breast on patient demand was used (pain score > 3). The other study (Kazmier et al. 2008) used continuous infusion of bupivacaine 0.5% at a rate of 2 mL/h. There was no significant improvement in pain scores compared with infusion of saline in the other breast, but the study was potentially limited by use of an intra-patient pain comparison model.

Expert opinion
Although ropivacaine application was effective, no difference in effect was found between doses (0.25% and 0.5%), and the lower dosage is therefore suggested.
Evidence grade: Moderate
Bupivacaine 0.5% at 2 mL/h was not effective in this setting.
Evidence grade: Low
Duration of infusion
• Intermittent surgical site infusion was continued for up to 48 h in the positive study (Rawal et al. 2006).

Expert opinion
Up to 48 h intermittent administration is suggested, but duration should be tailored to the patient’s needs.
Evidence grade: Moderate

Practical details for augmentation mammoplasty (Pacik 2004)

Catheter type
• A fenestrated catheter and scalp vein catheter were used.

Expert opinion
A fenestrated catheter has been used in several studies (Holmgren & Tarpila 2005, Pacik 2004, Rawal et al. 2006, Schell 2006) and is therefore suggested. Due to lack of evidence, the use of a scalp vein catheter is not suggested.
Evidence grade: Moderate

Catheter placement
• The catheter was placed posterior to the implant, with the catheter tip placed superior to the implant.

Expert opinion
Placement of the catheter tip superior to the prosthesis is suggested.
Evidence grade: Moderate

Preclosure bolus administration
• Bupivacaine 0.25% of unknown volume, was used for testing catheter flow only.

Expert opinion
Although not yet evaluated, a bolus infiltration is suggested to reduce immediate postoperative pain.
Evidence grade: Very low

Drug and dosing regimen
• Continuous surgical site infusion with bupivacaine 0.25% at a rate of 2 mL/h for each breast was used.
**Expert opinion**
Continuous surgical site infusion of bupivacaine 0.25% is suggested in this setting.
Evidence grade: **Moderate**

**Duration of infusion**
- Infusion lasted approximately 48 h.

**Expert opinion**
Continuous surgical site infusion for 48 h is suggested, but duration should be tailored to the patient’s needs.
Evidence grade: **Moderate**

**Practical details for reduction mammaplasty (Holmgren & Tarpila 2005)**

**Catheter type**
- A fenestrated catheter with bacterial filter was used.

**Expert opinion**
Multiholed catheters have been shown to be effective, and are suggested.
Evidence grade: **Moderate**

**Catheter placement**
- A catheter was placed in each breast, leaving the surgical site in the lateral margin of the submammary incision, secured with a single suture.

**Expert opinion**
The suggested placement for catheters is in the superior section of the surgical site, to allow gravity to distribute the local anaesthetic, as opposed to drains, which are usually placed inferiorly. Anchoring of catheters with sutures might be helpful, although sutures have been shown to damage catheters and render them ineffective. Further investigation is required.
Evidence grade: **Moderate**

**Preclosure bolus administration**
- Immediately after surgical site closure, 5 mL bupivacaine 0.25% was infiltrated into each breast over a period of 1 min.
**Expert opinion**
A preclosure bolus infiltration is suggested to reduce immediate postoperative surgical site pain. However, patients receiving postoperative pain medication and/or PCSSA pumps on a routine basis might not benefit as much from a preclosure bolus.
Evidence grade: **Low**

**Drug and dosing regimen**
- Intermittent surgical site infusion with 5 mL bupivacaine 0.25% over 1 min every 5 h was used.

**Expert opinion**
Bupivacaine has been shown to be effective in the above doses and regimen, and is suggested.
Evidence grade: **Moderate**

**Duration of infusion**
- Surgical site infusion was performed five times in 24 h.

**Expert opinion**
In this setting, intermittent surgical site infusion is suggested for at least 1 day, but duration should be tailored to the patient’s needs.
Evidence grade: **Low**

**Practical details for unilateral secondary breast reconstruction (Legeby et al. 2009)**

**Catheter type**
- An epidural catheter with bacterial filter was used.

**Expert opinion**
This was the only study to use an epidural catheter. In other studies, multiholed catheters have been shown to be effective, and are suggested.
Evidence grade: **Moderate**

**Catheter placement**
- A catheter was placed in the subpectoral dissected pocket for the expander prosthesis.

**Expert opinion**
It is unclear if the catheter was placed superiorly or inferiorly in the dissected pocket. Superior placement is suggested, opposite to the wound drain.
Evidence grade: **Moderate**
**Preclosure bolus administration**
- Not used.

**Expert opinion**
A preclosure bolus infiltration is suggested, but has not been evaluated so far in this setting.
Evidence grade: *Very low*

**Drug and dosing regimen**
- Intermittent surgical site infusion with 15 mL levobupivacaine 0.25% every 3 h was used.

**Expert opinion**
Levobupivacaine has been shown to be effective in the above doses and regimen, and is suggested.
Evidence grade: *Moderate*

**Duration of infusion**
- Surgical site infusion was performed over 45 h.

**Expert opinion**
In this setting, intermittent surgical site infusion is suggested for at least 45 h, but duration should be tailored to the patient’s needs.

**Evidence grade: Low**

**Practical details for bilateral breast reduction with supplemental liposuction (Rawlani et al. 2008)**

**Catheter type**
- A fenestrated catheter was used.

**Expert opinion**
Multiholed catheters have been shown to be effective, and are suggested.
Evidence grade: *Moderate*

**Catheter placement**
- A catheter was placed along the pectoralis fascia.

**Expert opinion**
Superior placement within the wound area is suggested.
Evidence grade: *Moderate*

**Preclosure bolus administration**
- Not used.
**Expert opinion**
A preclosure bolus infiltration is suggested, but has not been evaluated so far in this setting.
Evidence grade: Very low

**Drug and dosing regimen**
- Continuous infusion of bupivacaine 0.25% (5 mL/h) was performed. In addition, patients could administer a bolus dose of 2 mL bupivacaine 0.25% on an hourly basis.

**Expert opinion**
Continuous infusion of bupivacaine has been shown to be effective in the above doses and regimen, and is suggested.
Evidence grade: Moderate

**Duration of infusion**
- Surgical site infusion was performed for up to 55 h, depending on the number of boluses administered.

**Expert opinion**
In this setting, continuous infusion is suggested for at least 48 h, but duration should be tailored to the patient’s needs.
Evidence grade: Low

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**Practical details for modified radical mastectomy with axillary node dissection (Sidiropoulou et al. 2008)**

**Catheter type**
- Two fenestrated catheters were used.

**Expert opinion**
Multiholed catheters have been shown to be effective, and are suggested.
Evidence grade: Moderate

**Catheter placement**
- Two catheters were placed subcutaneously, one with a loop over the pectoral muscle and the other in the axillary dissection area.

**Expert opinion**
Superior placement within each wound area is suggested. If used, a wound drain should be placed opposite and inferiorly in the wound area.
Evidence grade: Moderate
**Preclosure bolus administration**
- Not used.

**Expert opinion**
A preclosure bolus infiltration is suggested, but has not been evaluated so far in this setting.
Evidence grade: **Very low**

**Drug and dosing regimen**
- Continuous infusion of ropivacaine 0.5% at a rate of 4 mL/h (2 mL/h in each catheter) was performed.

**Expert opinion**
Continuous infusion of ropivacaine has been shown to be effective in the above doses and regimen, and is suggested.
Evidence grade: **Moderate**

**Duration of infusion**
- Surgical site infusion was performed for 24 h.

**Expert opinion**
In this setting, continuous infusion is suggested for at least 24 h, but duration should be tailored to the patient’s needs.
Evidence grade: **Low**

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**Key messages for breast and axillary surgery**
- Continuous surgical site infusion with local anaesthetics reduces postoperative pain and opioid medication in breast and/or axillary procedures.
- Continuous surgical site infusion is useful in a large variety of benign and non-benign breast and/or axillary procedures.
- Continuous surgical site infusion is applicable in mastectomy (with or without axillary lymph node dissection), breast augmentation, mammaplasty, or breast reduction.
- A fenestrated catheter is suggested to be placed superior to the surgical site cavity.
- Bupivacaine 0.25% at a flow rate of 2 mL/h per catheter is suggested for immediate postoperative pain management of up to a few days duration.
- Further studies are needed to confirm optimal catheter placement and to assess the effectiveness of a postoperative bolus.
References

For a list of additional references and suggestions for further reading, see Appendix 4.


