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## CORRESPONDENCE AND COMMUNICATION

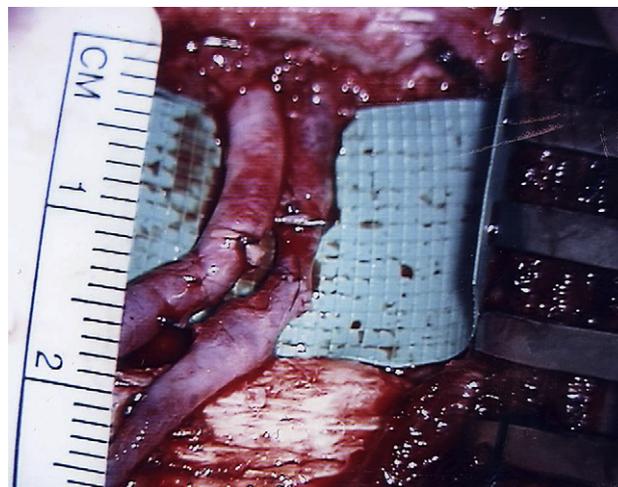
## Analgesia requirements in patients undergoing diep flap breast reconstructions: Rib preservation versus rib sacrifice<sup>☆</sup>

Internal mammary vessel (IMV) exposure for free-flap breast reconstruction (BR) traditionally entails removal of a segment of the 3rd costal cartilage, but has been reportedly associated with early local pain and long term tenderness.<sup>1</sup> The technique of total rib-preservation exposes the IMV's between adjacent ribs and allows adequate space for microvascular anastomosis, thereby avoiding rib-sacrifice<sup>2</sup> (Figure 1). It has been suggested that such a rib-sparing technique may reduce postoperative pain,<sup>1</sup> but this has never been objectively assessed.

The senior author (CMM) adopted total rib-preservation of IMV preparation following a specific patient request in May 2008 and has exclusively used it for all subsequent patients. We decided to test the hypothesis that patients undergoing deep inferior epigastric perforator (DIEP) flap BR's with rib-preservation experienced less postoperative pain compared to those with segmental rib cartilage resection.

### Patients and methods

Overall 34 patients with DIEP flap BR's using rib-preservation by a single surgeon between May 2008 and May 2010 were identified (Figure 2a). However, only the consecutive immediate unilateral DIEP flap BR's were selected ( $n = 12$ ) and retrospectively compared to the preceding 12 patients who had previously undergone the same surgery with the only difference being rib-sacrifice. Delayed and bilateral reconstructions and those with



**Figure 1** Intraoperative photograph of a right 2nd intercostal space showing the IMVs successfully anastomosed to the deep inferior epigastric vessels. The distance between the two ribs and thus the space available for the microvascular anastomoses was 19 mm.

contralateral balancing surgery were excluded as potential confounding variables that may exert a separate effect on postoperative pain.

Total morphine administered by patient-controlled analgesia (PCA) pump was considered a good indicator of early postoperative pain because patients can self-regulate the amount they use and are motivated to discontinue it as soon as they no longer need it.<sup>3</sup> Patients' subjective impression of pain was assessed using maximum pain scores, as documented on the opioid administration charts.

<sup>☆</sup> Presented at:

The 44th Congress of the European Society for Surgical Research (ESSR), Nîmes, France. May 23–26, 2009.

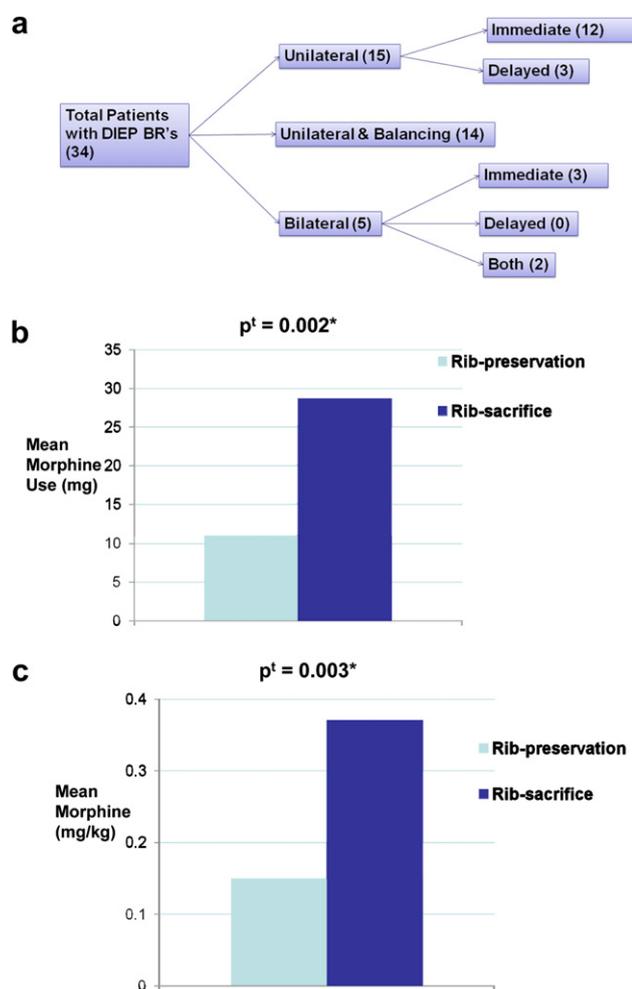
Canadian Society of Plastic Surgeons 63rd Annual Meeting, Kelowna, BC, Canada. June 16–20, 2009.

Society of Academic and Research Surgery Annual Meeting, Royal Free Hospital, London, UK. January 6-7, 2010.

British Association of Plastic, Reconstructive and Aesthetic Surgeons Summer Scientific Meeting, Sheffield, UK, June 30–July 2, 2010

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doi:10.1016/j.bjps.2010.08.002

Please cite this article in press as: Mickute Z, et al., Analgesia requirements in patients undergoing diep flap breast reconstructions: Rib preservation versus rib sacrifice, Journal of Plastic, Reconstructive & Aesthetic Surgery (2010), doi:10.1016/j.bjps.2010.08.002



**Figure 2** (a) Flow diagram showing the range of procedures within the group of patients who underwent DIEP flap breast reconstructions (BR's) using the rib-preservation technique. (b) Mean PCA Morphine use (mg) in Rib-preservation versus Rib-sacrifice immediate unilateral DIEP breast reconstructions (unpaired *t*-test). (c) Mean PCA Morphine use (mg/kg body weight) in Rib-preservation versus Rib-sacrifice immediate unilateral DIEP breast reconstructions (unpaired *t*-test).

## Results

All the flap transfers were successful and there were no significant differences in flap related complications (2 vs. 4,  $p = 0.32$ ; Fisher's Exact test). All the patients in this study were given intravenous morphine 20 mg and paracetamol 1 g prior to extubation and then allowed to self-regulate the amount of morphine they needed post-operatively via the PCA system. Patients in the rib-preservation group used significantly less total morphine than those undergoing rib-sacrifice (mean dose, 11.0 mg vs. 28.6 mg respectively;  $p = 0.002$ , unpaired *t*-test) (Figure 2b), confirmed by morphine used per kilogramme of body weight ( $p = 0.003$ , unpaired *t*-test) (Figure 2c). The mean number of hours spent connected to the PCA pump (33 h vs. 29 h respectively;  $p = 0.38$ ; Unpaired

*t*-Test) and maximum pain scores ( $p = 0.69$ ; Mann-Whitney U test) were comparable between the rib-preservation and rib-sacrifice patients.

## Discussion

A previous report suggested that rib preservation for IMV exposure during free-flap breast reconstruction reduces postoperative pain,<sup>1</sup> but evidence to support this claim has hitherto been lacking. Our study found that patients undergoing immediate unilateral DIEP flap breast reconstruction with rib-preservation used significantly less postoperative analgesia compared to those with rib-sacrifice, which was not attributable to the length of time they were connected to the PCA pump.

Since the maximum pain scores were similar we can assume that patients in both groups were using PCA morphine to control their pain with similar effect. The duration of PCA is guided by patient need, therefore the comparable hours spent on the PCA pump between the two groups suggests rib-preservation does not alter the length of time that postoperative pain is experienced. This study supports the beneficial effect of rib-preservation on early postoperative pain but we cannot comment on any effects on late postoperative pain or long term tenderness.

The early pain is thought by some to be primarily related to the rib resection.<sup>4</sup> However, another mechanism may be at play; chest wall pain following harvest of the IMVs has been a well-reported phenomenon in the cardiothoracic literature, originally termed the 'internal mammary syndrome' and thought to be related to damage of intercostal nerves at the time of vessel harvest.<sup>5</sup> It may thus be due to the fact that the nerves are left intact, rather than because the rib is preserved *per se*, which is responsible for any reduction in postoperative pain during rib-sparing.

There was no adverse effect on flap outcomes, specifically with regards to flap survival, suggesting that IMV dissection within the rib interspace does not hinder microvascular anastomosis. Interestingly, a previous study found no significant difference in warm ischaemia time for free flaps undergoing rib-preservation compared to rib-sacrifice,<sup>2</sup> providing further support that time taken to anastomose the vessels is not affected by the limited operating area afforded by this new technique.

Although this study has shown that rib-preservation may have a beneficial effect on early postoperative pain in patients undergoing immediate unilateral DIEP BR's, larger studies are needed to confirm this relationship and investigate whether it is held true for patients undergoing different types of microvascular reconstructions, bilateral procedures as well as those with simultaneous contralateral balancing breast surgeries.

## Financial disclosure

The authors have no financial interest in the technique described or the drugs used for this study.

## Conflicts of interest statement

The authors have no conflicts of interest to declare.

## Acknowledgements

There are no other contributors to this article whether in the form of writing, technical help or otherwise.

## References

1. Parrett BM, Caterson SA, Tobias AM, et al. The rib-sparing technique for internal mammary vessel exposure in microsurgical breast reconstruction. *Ann Plast Surg* 2008;**60**:241–3.
2. DiCandia M, Moses M, Mickute Z, et al. Internal mammary vessel exposure with total rib preservation during free flap breast reconstruction – technique and pitfalls. *Br J Surg* 2009;**96**(S5):67.
3. Kroll SS, Sharma S, Koutz C, et al. postoperative morphine requirements of free TRAM and DIEP flaps. *Plast Reconstr Surg* 2001;**107**:38–41.
4. Srivastava A, Tripathi DM, Zaman W, et al. Subcostal versus transcostal mini donor nephrectomy: is rib resection responsible for pain related donor morbidity. *J Urol* 2003;**170**:738–40.
5. Mailis A, Umana M, Feindel CM. Anterior intercostal nerve damage after coronary artery bypass graft surgery with use of internal thoracic artery graft. *Ann Thorac Surg* 2000;**69**:1455–8.

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