A Novel Treatment Approach to Postoperative Thoracotomy Pain

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Posterior lateral thoracotomy is frequently performed and remains quite painful. Studies have shown that chronic pain (defined as pain after 6 months) is common and can occur in up to 67% of patients who have had a thoracotomy. Over the past four years we have studied the problem of pain from thoracotomy using several prospective trials and although some have failed to reduce pain some have been successful. We postulated that the majority of pain was from trauma to the intercostal nerves. In 2003 we reported a prospective study that showed that sutures placed through the ribs (intracostal sutures) decreased the pain when compared to sutures that go around the ribs (paracostal sutures) during thoracotomy closure. D’Andrilli in 2006 showed in a prospective study that pre-emptive injection of a local anesthetic prior to rib spreading (but after incision to ensure proper injection) in the ICM also reduces pain. In 2005 we reported another prospective randomized study that showed that the harvesting of an intercostal muscle flap (ICM) prior to rib spreading to avoid the ICM and the intercostal nerve that runs in it from being crushed by the retractor also reduced pain. In that study the ICM was harvested, as shown in Figure 1 and was cut distally and reflected posteriorly so as not to obstruct the surgeon’s view during the operation. In this current study, the third study shown in today’s lecture, all patients had an ICM harvested prior to rib spreading. However, half of the patients had the ICM and the intercostal nerve that runs in it left in tact distally and the other half had the muscle cut and reflected posteriorly as we had been doing previously. The two different techniques are shown in Figure 1 and the results of this randomized study are presented.
Figure 1: Intracostal Muscle (ICM) Flap

Acute and chronic pain remains one of the most common problems after thoracotomy and thus we have performed several prospective studies to identify ways to reduce it. Video-assisted thoracoscopy is an increasingly used technique that may also reduce pain but still few pulmonary resections in the United States are performed in this manner. More importantly, it is common for patients to complain about neuralgic type pain at the incisions from injury to the intercostal nerve caused by the instruments that are placed through the small openings which often compress the nerve. Although we believe more and more operations will be performed using VATS techniques a certain percentage may not be able to be performed in this manner and some data suggests that
lung palpation may be preferred for patients with cancer. Thus thoracotomy will probably remain a common procedure for general thoracic surgeons even in the foreseeable future.

In this prospective randomized trial we have shown a third technique that when added to the other two techniques we have previously described further reduces the pain of thoracotomy. In this study we found that the harvesting of an intercostal muscle flap and then leaving the flap intact distally and not cutting it (and thus the intercostal nerve that runs in it) may further reduce post-operative thoracotomy pain. The strengths of this study include not only some of the techniques that we have featured in our previous studies (one surgeon, the use a pain script, the timing of the pain assessment, objective pain scores, etc) but in addition some improvements. For example, in this series we excluded patients who had received neo-adjuvant therapy to exclude interaction and confounding factors, we clarified the language in our pain survey script to avoid ambiguity such as in place of “narcotic” we used “prescription” and we more definitively described “return to baseline activities” and we obtained data on POD 5. The limitations of this study however remain the same as our other studies and revolve around the inherently subjective nature of pain.

In 2005 we showed that harvesting an intercostal muscle resulted in more broken ribs. This may be due to the upper rib being less protected after the muscle has been removed from it. However, this was not associated with increased pain and this is probably because when we close the chest in a patient who has suffered a broken rib we ensure the two edges do not rub against one another. A small piece is removed to ensure this does not occur. In this study we found more ribs were broken in the divided group than the dangle group.

The dangle technique obviously does not allow for the ICM to be transposed into the chest and thus we do not recommend it for patients who have an indication for bronchial buttressing or esophageal buttressing. This includes patients who have had pre-operative radiation, chemotherapy, those who are immunocompromised, etc. Therefore its only advantage is for the reduction of pain. In this study we employed very strict entry criteria to ensure that
other factors did not affect our results and thus eliminated a large number of patients but this was only used to ensure the study’s accuracy. However, in our practice we do use a dangling ICM for most all patients including those who undergo redo-thoracotomy or for patients who are on Methadone pre-operatively. It is part of our routine regimen for any posterior lateral thoracotomy unless the ICM is needed inside the chest. We usually only harvest the muscle the length of the retractor’s blades to ensure the ICM nerve is not crushed by the chest retractor. We prefer to keep the cautery setting on 70 throughout the case and during ICM harvesting because we believe the operation is more efficient this way. If the cautery is swiftly passed under the rib there does not seem to be thermal injury to the underlying muscle and nerve. The harvesting of the ICM only takes 30 – 45 seconds. However, setting the cautery level lower may be needed if harvesting is not done with alacrity. If an osteal elevator is used to harvest the ICM, osteoclasts will remain on the muscle and the flap may calcify. Although some believe this is a problem with the ICM, if the flap is used to buttress a closed bronchus (i.e. after lobectomy or pneumonectomy) calcification may be a desired characteristic. However, if the ICM is used to wrap part of (we never recommend 360 degrees wrapping of anything with any flap) a sleeve resection of the pulmonary artery or the bronchus then calcification over time may represent a problem. For this reason we prefer the use of cautery to harvest the ICM and with this technique the flap does not calcify over time. xii

In conclusion, we have shown that the harvesting of an intercostal muscle flap and leaving the muscle intact so it dangles under the chest retractor leads to the further reduction of the pain of thoracotomy. When the ICM is needed to cover an irradiated bronchus or to repair a perforated esophagus we still recommend its use and that of course requires distal division for transposition to the area in the chest that requires buttressing. However in a standard thoracotomy we recommend harvesting the muscle prior to rib spreading and leaving the muscle intact distally and allow it to dangle. Patients who undergo this technique have less pain, and when added to rib drilling these techniques together lead to reduced pain on post-operative weeks
3-12. They together reduce the need for prescription analgesics and lead to a quicker return to baseline activity. Pain, like any other post-operative complication is best treated by prevention. Acute pain control helps prevent chronic pain syndrome. iv Thus future studies should examine other, easily reproducible and inexpensive ways to reduce the pain of thoracotomy or video-assisted thoracoscopy such as drilling holes in the bottom rib, injecting local anesthetic in the nerves prior to chest retraction and the harvesting and not cutting of an intercostal muscle flap.


