

## Manuscript Details

<b>Manuscript number</b>	STCVS_2019_82
<b>Title</b>	Thoractomy: more gain with less pain
<b>Article type</b>	Editorial
<b>Abstract</b>	None provided
<b>Keywords</b>	thoracotomy; pain; phrenic nerve; RCT
<b>Manuscript category</b>	Thoracic
<b>Corresponding Author</b>	Tom Treasure
<b>Corresponding Author's Institution</b>	UCL
<b>Order of Authors</b>	Tom Treasure

## Submission Files Included in this PDF

### File Name [File Type]

Commentary 190504 0802.docx [Manuscript File]

To view all the submission files, including those not included in the PDF, click on the manuscript title on your EVISE Homepage, then click 'Download zip file'.

## Research Data Related to this Submission

There are no linked research data sets for this submission. The following reason is given:  
No data was used for the research described in the article

Thoractomy: more gain with less pain

Proof of clinical effectiveness ranges from simple to extremely complex. Relieving tension pneumothorax needs only observation: the hiss of escaping air is accompanied by evident clinical improvement, incontrovertibly linking intervention and benefit. At the difficult end is prevention of postoperative pain. A mix of aetiologies, patient subjectivity, observer biases, and the competing effects of therapeutic strategies, make it difficult to be sure of the effect of any one component. A randomised controlled trial (RCT) with blinding of patients and observers is the best way to be sure. RCTs have called a halt to many treatments shown to not benefit patients [1], but they are an exacting discipline. Krishnamoorthy and colleagues[2] call for further research, (as authors often do) but a lot is known already and some of remaining uncertainties are amenable to observational study.[3]

What is the cause of shoulder pain after thoracotomy? It may be attributable to the position imposed on the anaesthetised patient. In the 1970s my mentors took great care in positioning their patients. Later I noted that some patients after median sternotomy had numbness in the hand, attributed to ulnar nerve pressure. On examination the sensory loss was in C8/T1 sensory distribution pointing to a brachial plexus lesion. In a prospective study in 200 patients there were denervation potentials in chest wall muscles of affected patients.[4] Trials are the most reliable way to test treatments but original discoveries are often chance observations.[5] With changes in securing the arms and the extent of sternal retraction the problem resolved. In positioning patients for muscle-sparing[6] and video assisted surgery, the shoulder may pay a penalty.

Referred pain from the diaphragm is the other candidate. Received wisdom casts suspicion on the basal drain. That cause should have been eliminated by protocol in Krishnamoorthy's study. "A size 28Fg chest tube was placed as an apical drain according to our local surgeon's practice." [2] Perhaps the position of the apostrophe provides a clue; pleural drainage is such a personal matter[7] that there may have been deviations from protocol. Why not review the radiographs and count the drains and their position? Pain data are already on record. Brought together for independent and unbiased analysis, an association could be tested. Verification of protocol adherence is a useful component of RCTs. In a randomised trial of stopping or continuing aspirin before coronary surgery, blood and urine samples showed 99% compliance providing mechanistic verification of the empirical findings of the RCT.[8]

The authors state that diaphragmatic paralysis due to phrenic nerve block "has not yet been proven" [2] It clearly has. A PubMed search for [(phrenic nerve block) OR (phrenic nerve infiltration)] AND [(diaphragm\*) AND (paralysis)] found 12 papers, mainly reporting inadvertent paralysis of the diaphragm with brachial plexus block. Furthermore, there is evidence of reduced lung function. [9-11] This effect has been used therapeutically to reversibly manage residual pleural space after lung resections.[12] Blocking the phrenic nerve is a precise localised intervention and it is possible to get a long way in reducing the unknowns by observation. No dentist or dental patient is in doubt about the efficacy of a nerve block and that didn't require an RCT.

The decrease in the incidence and severity of shoulder pain with nerve block supports the role of the phrenic nerve in its transmission.[11;13-16]. It is interesting to me that shoulder pain seems to have reappeared as a problem. The anaesthesiologist Nigel Scrawn who has contributed so much to reducing patients' suffering[13-15] tell me that shoulder pain appeared as a thoracotomy plus epidural phenomenon. It was only noticed by the patients if

the epidural was effective and providing good analgesia to the chest wall. If the patients had incision pain then they rarely complained of shoulder pain. If the epidural worked well, and there was a good phrenic nerve block removing shoulder pain, patients were aware of pain from their IVs.

Reduction in breathing capacity is a consequence to be taken into account. It was unlucky that there was imbalance in patients' breathing capacity preoperatively making change difficult to evaluate in this study. A way to avoid it would have been to minimise differences in known confounders between study arms, to ensure balance.[17] Unless minimisation is done independently and out of sight of the investigators it introduces a risk of manipulation of treatment assignment but with those safeguards it saves troublesome imbalance which can undermine a trial.

The phrase 'real world data' is increasingly used in justification of doctors' unwillingness to do proper trials.[18] I disagree: trials should and do reflect *reality* as illustrated by this trial with all its interaction, confounders and uncertainties. RCTs test whether useful net benefit be detected amongst the 'noise' to make it worth adding yet another intervention. That is the real world question in clinical practice which is most reliably answered by RCTs.

#### Reference List

- 1 Prasad V, Vandross A, Toomey C, Cheung M, Rho J, Quinn S, Chacko SJ, Borkar D, Gall V, Selvaraj S, Ho N, Cifu A: A decade of reversal: an analysis of 146 contradicted medical practices. *Mayo Clin Proc* 2013;88:790-798.
- 2 Krishnamoorthy B, Critchley WR, Soon SY, Birla R, Begum Z, Nair J, Devan N, Mohan R, Fildes J, Morris J, Fullwood C, Krysiak P, Malagon I, Shah R: A Randomized Study Comparing the Incidence of Postoperative Pain After Phrenic Nerve Infiltration Vs Nonphrenic Nerve Infiltration During Thoracotomy. *Semin Thorac Cardiovasc Surg* 2018.
- 3 Mokhles S, Takkenberg JJ, Treasure T: Evidence-Based and Personalized Medicine. It's [AND] not [OR]. *Ann Thorac Surg* 2017;103:351-360.
- 4 Treasure T, Garnett R, O'Connor J, Treasure J: Injury of the lower trunk of the brachial plexus as a complication of median sternotomy for cardiac-surgery.; 1980, p 378.
- 5 Mukherjee S: *The Laws of Medicine: Field Notes from an Uncertain Science*. TED Books, 2015.
- 6 Ohmori A, Iranami H, Fujii K, Yamazaki A, Doko Y: Myofascial involvement of supra- and infraspinatus muscles contributes to ipsilateral shoulder pain after muscle-sparing thoracotomy and video-assisted thoracic surgery. *J Cardiothorac Vasc Anesth* 2013;27:1310-1314.

- 7 Lang P, Manickavasagar M, Burdett C, Treasure T, Fiorentino F: Suction on chest drains following lung resection: evidence and practice are not aligned. *Eur J Cardiothorac Surg* 2016;49:611-616.
- 8 Kallis P, Tooze JA, Talbot S, Cowans D, Bevan DH, Treasure T: Pre-operative aspirin decreases platelet aggregation and increases post-operative blood loss--a prospective, randomised, placebo controlled, double-blind clinical trial in 100 patients with chronic stable angina. *Eur J Cardiothorac Surg* 1994;8:404-409.
- 9 Urmev WF, Talts KH, Sharrock NE: One hundred percent incidence of hemidiaphragmatic paresis associated with interscalene brachial plexus anesthesia as diagnosed by ultrasonography. *Anesth Analg* 1991;72:498-503.
- 10 Urmev WF, McDonald M: Hemidiaphragmatic paresis during interscalene brachial plexus block: effects on pulmonary function and chest wall mechanics. *Anesth Analg* 1992;74:352-357.
- 11 Elfokery BM, Tawfic SA, Abdelrahman AM, Abbas DN, Abdelghaffar IM: Comparative study on the analgesic effect of acute ipsilateral shoulder pain after open thoracotomy between preoperative ultrasound guided suprascapular nerve block (SNB) and intraoperative phrenic nerve infiltration (PNI) in cancer lung patients. *J Egypt Natl Canc Inst* 2018;30:27-31.
- 12 Patella M, Saporito A, Mongelli F, Pini R, Inderbitzi R, Cafarotti S: Management of residual pleural space after lung resection: fully controllable paralysis of the diaphragm through continuous phrenic nerve block. *J Thorac Dis* 2018;10:4883-4890.
- 13 Scawn ND, Pennefather SH, Soorae A, Wang JY, Russell GN: Ipsilateral shoulder pain after thoracotomy with epidural analgesia: the influence of phrenic nerve infiltration with lidocaine. *Anesth Analg* 2001;93:260-4, 1st.
- 14 Tan N, Agnew NM, Scawn ND, Pennefather SH, Chester M, Russell GN: Suprascapular nerve block for ipsilateral shoulder pain after thoracotomy with thoracic epidural analgesia: a double-blind comparison of 0.5% bupivacaine and 0.9% saline. *Anesth Analg* 2002;94:199-202, table.
- 15 Pennefather SH, Akrofi ME, Kendall JB, Russell GN, Scawn ND: Double-blind comparison of intrapleural saline and 0.25% bupivacaine for ipsilateral shoulder pain after thoracotomy in patients receiving thoracic epidural analgesia. *Br J Anaesth* 2005;94:234-238.
- 16 Danelli G, Berti M, Casati A, Bobbio A, Ghisi D, Mele R, Rossini E, Fanelli G: Ipsilateral shoulder pain after thoracotomy surgery: a prospective, randomized, double-blind, placebo-controlled evaluation of the efficacy of infiltrating the phrenic nerve with 0.2%wt/vol ropivacaine. *Eur J Anaesthesiol* 2007;24:596-601.
- 17 Treasure T, MacRae KD: Minimisation: the platinum standard for trials? *BMJ* 1998;317:362-363.
- 18 Treasure T, Takkenberg J: Randomised trials and big data analysis: we need the best of both worlds . *European Journal of Cardio-Thoracic Surgery*. In press.