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Can chronic neuropathic pain following thoracic surgery be predicted during the postoperative period?*


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Abstract

Chronic pain following thoracic surgery is common and associated with neuropathic symptoms, however, the proportion of patients with neuropathic pain in the immediate postoperative period is unknown. We aimed to determine the proportion of patients who have neuropathic symptoms and signs immediately after, and at three months following thoracic surgery. The study was designed as a prospective observational cohort study. We identified patients with pain of predominantly neuropathic origin using the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) score in the immediate postoperative period and the self-report LANSS (S-LANSS) version three months after surgery. One hundred patients undergoing video assisted thoracic surgery (VATS) or thoracotomy completed LANSS scores preoperatively and in the immediate postoperative period. Eighty-seven percent completed three months S-LANSS follow-up scores. Eight percent of patients had positive LANSS scores in the immediate postoperative period; 22% of patients had positive S-LANSS scores three months following surgery. There was a significant association between positive scores in the acute and chronic periods (relative risk (RR) 3.5, [95% confidence interval (CI) 1.7–7.2]). Identifying pain of predominantly neuropathic origin in the postoperative period with a simple pain score can help identify those at risk of developing chronic pain with these features following thoracic surgery.

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1. Introduction

Currently in the UK over 10,000 major thoracic surgical procedures are performed each year. Chronic pain following thoracic surgery is common; the prevalence is often reported as >50% [1, 2]. This pain has a significant impact on patients’ lives; >40% report that pain is their worst problem and that it limits their daily activities [1]. The cause of chronic pain following thoracic surgery is not fully understood, however, intercostal nerve damage and subsequent dysfunction has long been implicated in the development of chronic pain symptoms. Animal models of thoracotomy pain have demonstrated neuropathic symptoms (such as allodynia, following rib retraction) and patients with objective signs of nerve damage (such as loss of superficial abdominal reflexes) following surgery experience more severe acute and chronic pain [3–5]. Maguire et al. investigated intercostal nerve damage at the time of operation and demonstrated two patterns of nerve injury, suggesting this reflected damage from pressure related to rib retraction and damage caused by friction on the nerve [6]. Neuropathic pain mechanisms are, therefore, likely to contribute towards the postoperative pain experience, however, few studies have investigated the epidemiology of neuropathic pain following thoracic surgery. In a retrospective postal survey of 600 thoracic surgery patients Maguire et al. concluded that chronic neuropathic pain (CNP) symptoms were common and associated with pain that is more severe, less likely to improve with time, has a greater impact on patients’ lives, involves more analgesia use, limits daily activities and is their worst medical problem [1]. More recently Steegers et al. used a validated questionnaire to determine the incidence of CNP following thoracic surgery, concluding that of those with chronic pain, 53% had neuropathic pain [7]. However, these studies were retrospective postal surveys, conducted at widely varying time points from the original surgery, with no information on the existence of neuropathic pain before the operation.

It is clear that CNP does occur following thoracic surgery, however, the proportion of patients experiencing acute neuropathic pain (ANP) in the thoracic surgery population is not known. Although pain intensity in the immediate postoperative period is known to be related to the development of chronic pain after thoracic surgery, it is not known if pain character predicts development of CNP in this surgical population [8].

We aimed to determine the incidence of ANP and CNP following thoracic surgery and hypothesized that the occurrence of ANP characteristics following thoracic surgery
would be associated with significantly higher odds of developing CNP characteristics at three months follow-up.

2. Methods

The study was designed as a prospective, observational cohort study. After Ethics Committee approval, adult patients admitted to St James’s University Hospital (Leeds, UK) for video assisted thoracic surgery (VATS) or posterolateral thoracotomy were recruited. Patients were excluded if they had previously undergone VATS or thoracotomy, had previously diagnosed neuropathic pain or were pregnant.

We wanted to assess the proportion of patients who experienced ANP characteristics following thoracic surgery and the subsequent incidence of CNP characteristics three months later. To do this we used validated neuropathic pain screening tools: Leeds Assessment of Neuropathic Symptoms and Signs (LANSS), and the related self-complete version (S-LANSS) [9, 10]. These tools are designed to identify patients with pain of predominantly neuropathic origin and positive scores are indicative of neuropathic pain but are not diagnostic. We used screening tools rather than clinician assessment alone, to ensure consistency and reduce missing data between assessments in the acute and follow-up periods.

Following informed consent, a medical researcher performed a baseline preoperative LANSS score on the day before scheduled surgery (performing the examination items at the expected site of surgery). Patients who had positive LANSS scores at this stage were withdrawn from the study. Patient demographics and the operation performed were recorded. During the postoperative period the medical researcher repeated the LANSS score whilst the patient was in hospital. This examination was conducted at least 24 h after regional or local anaesthetic infusion or injection had ceased. Three months following their operation, patients were sent an S-LANSS questionnaire by post. None of the 100 patients had preoperative neuropathic pain (LANSS ≥12). The postoperative LANSS score was performed an average of three days following surgery in each of the three surgical procedure groups (VATS, thoracotomy and both VATS and thoracotomy). Eight (8%) patients developed ANP in the early postoperative period (LANSS score ≥12). Eighty-seven of these 100 patients subsequently completed postal or telephone S-LANSS questionnaires an average (mean) of 110 days following their operation (range, 86–213 days). Of these 87 patients, 19 (22%) had CNP (S-LANSS ≥12). Eighty-five of the 100 patients completed the numerical rating scores (NRS) pain intensity scale at follow-up. Of these, 53 (62%) had chronic

### Table 1

<table>
<thead>
<tr>
<th>Type of operation</th>
<th>Intravenous morphine (via patient controlled analgesia device)</th>
<th>Thoracic paravertebral block</th>
<th>Thoracic epidural</th>
<th>Intercostal nerve block</th>
</tr>
</thead>
<tbody>
<tr>
<td>VATS</td>
<td>33 (67%)</td>
<td>24 (49%)</td>
<td>1 (2%)</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Thoracotomy</td>
<td>41 (85%)</td>
<td>39 (81%)</td>
<td>5 (10%)</td>
<td>7 (12.5%)</td>
</tr>
<tr>
<td>VATS and thoracotomy</td>
<td>3 (100%)</td>
<td>2 (66%)</td>
<td>1 (33%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>All procedures</td>
<td>77%</td>
<td>65%</td>
<td>7%</td>
<td>11%</td>
</tr>
</tbody>
</table>

VATS, video assisted thoracoscopic surgery.
no single analgesic technique was associated with the subsequent development of CNP.

There was a correlation between the total postoperative LANSS score and the later three months S-LANSS total; r-value of 0.33 (P<0.001). Patients with CNP (S-LANSS ≥12) had significantly higher NRS (median=5) than those with nociceptive pain (median=2, P=0.002 Mann–Whitney U-test) at three months follow-up. There was no significant correlation between the postoperative LANSS score and the three-month NRS pain intensity score (median=1 for nociceptive pain; median 3.5 for neuropathic pain, P=0.09).

4. Discussion

We found that 8% of patients undergoing major thoracic surgery developed ANP characteristics in the immediate postoperative period and that 22% of patients have CNP characteristics three months after their operation. Furthermore, our study demonstrates that the presence of acute pain of predominantly neuropathic origin is significantly associated with development of CNP characteristics three months later.

Maguire et al. demonstrated CNP symptoms in 35–85% of patients with pain in a postal questionnaire survey of post-thoracic surgery patients, although they did not use a validated neuropathic pain tool [1]. More recently, researchers demonstrated 23% of patients had CNP in a result very similar to our own, using a different validated scale [7]. The prevalence of ANP symptoms in this population has not been previously described. Hayes et al. estimated the incidence of ANP as 1–3% of all surgical patients, although this study only included one case following thoracotomy and patients were not screened for pre-existing neuropathic pain [12]. Our results show a small but significant proportion of thoracic surgery patients have ANP characteristics and importantly that this predicts the development of CNP. However, three patients with acute neuropathic characteristics did not develop CNP, suggesting that the natural history of acute neuropathic symptoms and signs may be that over a third of cases spontaneously resolve in the first three months.

The majority of patients who developed CNP (74%) did not have neuropathic pain characteristics in the immediate postoperative period, although they had significantly higher average LANSS scores compared to patients who did not develop CNP. It is not clear whether this reflects a different pathophysiological process, or if it reflects a reduction in the sensitivity of the LANSS score when used in the early postoperative period. Although the LANSS score has been validated in a mixed population of patients with neuropathic pain, it has not been specifically designed for use in the early postoperative period [9]. However, despite this it has been used successfully in other acute pain contexts and it remains an easy to use bedside tool for identifying neuropathic pain [13]. More work is needed to develop a validated tool to aid diagnosis of neuropathic pain in the immediate postoperative period.

Identification of ANP offers opportunities to test interventions to reduce the development of CNP and we believe that further research is needed in this area. However, it is important to note that the majority of patients with CNP.
do not have sufficient symptoms and signs of neuropathic pain in the immediate postoperative period for a diagnosis of ANP, although they do have significantly higher average postoperative LANSS scores. Few studies have looked at the impact of peri-operative antineuropathic medication to reduce chronic post-surgical pain, and the results are inconclusive [14, 15].

In summary, ANP following major thoracic surgery predicts the development of CNP and therefore, offers the opportunity to screen and to intervene to reduce the development of CNP. However, screening for chronic pain at surgical follow-up remains important.

Acknowledgments

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References