A questionnaire study investigating the prevalence of the neuropathic component of chronic pain after thoracic surgery

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Abstract

Objective: Our questionnaire study set out to assess the prevalence of chronic pain after thoracic surgery, the contribution of the neuropathic component of chronic pain and the impact of chronic pain on patients' lives. Methods: A questionnaire was sent to 1152 patients who had undergone thoracic surgery in our department between 7 months and 7 years ago. The questionnaire was designed specifically for the study and included questions on neuropathic symptoms. Responses were correlated with data from our prospectively entered database for analysis. Results: Nine hundred and forty-eight people were included in the study, of which 600 responded (63%). Prevalence of chronic pain is 57% at 7—12 months, 36% at 4—5 years and 21% at 6—7 years. Patient age, consultant and time since the operation all have significant effects. Surgical approach (video-assisted thoracoscopic surgery, thoracotomy) and diagnosis are not significant. Thirty-nine percent of those with pain take analgesia, 46% felt their pain is their worst medical problem and 40% reported it limits their daily activities. The prevalence of each neuropathic symptom is between 35 and 83%. The presence of a neuropathic symptom is associated with significantly more severe pain, more analgesia use and pain more likely to limit daily activity. Conclusions: Chronic pain has a significant prevalence and impact on patients' lives for several years after thoracic surgery. Nerve dysfunction is associated with more severe pain, a greater impact and tends to persist. The reason for the individual consultant being an important factor in post-thoracotomy pain needs further investigation.

Keywords: Chronic pain; Neuropathic pain; Thoracotomy; VATS

1. Introduction

Reports in the literature find the prevalence of chronic pain after thoracic surgery to be 9—80% for thoracotomies and 5—33% for video-assisted thoracoscopic surgery (VATS), although studies comparing the two approaches did not show significant differences beyond 1 year post-operative [1—14]. This large variance may be caused by how the authors defined chronic pain, how long after surgery it was assessed, how the data were collected, operative technique and method of analgesia used. Some studies have also reported the impact the pain has on patients' lives and how it limits their daily activity [9,10,13]. What is clear is that it is a significant problem that requires further investigation.

Studies have shown that high levels of immediate post-operative pain are associated with an increase in the likelihood of chronic pain [12]. The cause of the chronic pain has not been established. However, there is evidence to suggest this pain has a neuropathic component resulting from nerve damage at the time of surgery. Studies have shown intercostal nerve damage by demonstrating loss of intercostal nerve conduction during surgery and the loss of abdominal reflexes after thoracic surgery is associated with pain [15,16]. Also, chronic pain is frequently accompanied by abnormal cutaneous sensation and is often treated with antidepressants and antipsychotics rather than opiates.

Our aim was to investigate the prevalence of the neuropathic component of chronic pain after thoracic surgery and whether the presence of neuropathic symptoms influenced the severity and impact of chronic pain.

2. Material and methods

Patients were identified from our departmental thoracic surgery database which has data recorded prospectively since 1991. Selection criteria were all living patients who had undergone thoracic surgery involving VATS or thoracotomy performed in our unit between 7 years and 7 months prior to the start of this study. Patients were excluded if they had undergone more than one operation, if their death had not been recorded on our database, if they had thoracic operations other than a thoracotomy or VATS procedure or intercostal nerve damage by demonstrating loss of intercostal nerve conduction during surgery and the loss of abdominal reflexes after thoracic surgery is associated with pain [15,16]. Also, chronic pain is frequently accompanied by abnormal cutaneous sensation and is often treated with antidepressants and antipsychotics rather than opiates.

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if they had operation more than 7 years ago. Patients were
operated on by one of four consultants (A—D) and their
teams. All the consultants had their own method of
explaining the procedure to the patient, worked with
different anaesthetic staff, performed posterolateral thor-
acotomies differently, closed their thoracotomies differ-
ently, used varying sizes of chest drain and relied on different
methods of post-operative analgesia. Consultant C particu-
larly contrasts with the other three: he is the only one who
does not routinely resect a rib during thoracotomy; he closes
the thoracotomy with sutures that run over the upper border
of the rib above and under the lower border , but above the
intercostal bundle, of the rib below; and he relies more
heavily on pre-incisional blocks and paravertebral infusions
rather than epidurals.

2.1. Local ethics committee guidelines were followed

Patients were recruited by post and each was sent our
questionnaire (Table 1). Those patients who failed to respond
within 1 month were sent the questionnaire again. The study
closed 1 month after this. The questionnaire was devised
specifically for this study. Many of the questions are
commonly found in published validated questionnaires.
Questions 4—8 were included to identify symptoms asso-
ciated with neuropathic pain. These have been validated in
the context of the Leeds Assessment of Neuropathic
Symptoms and Signs (LANSS) Pain Scale that identified those
symptoms that helped distinguish neuropathic pain from
nociceptive pain [17]. Patient demographics, the operation
performed and the diagnosis were obtained from the
department database and correlated with the responses to
the questionnaire.

The data were analysed using the SPSS statistics software
package. Chi-square test ($\chi^2$) was used to compare groups
with categorical variables, independent $T$ test for compar-
ison of age and body mass index (BMI) and Mann–Whitney U-test for time since the operation. For multiple interdependent factor analysis multivariate logistic regression was used to compare groups.

3. Results

Questionnaires were sent to 1152 patients (Fig. 1). Two hundred and four patients (18%) were excluded: 133 had undergone more than one operation; 55 patients had died out of hospital and had not been recorded on our database; 11 had thoracic operations other than a thoracotomy or VATS procedure; and 5 had their operation more than 7 years ago. Nine hundred and forty-eight patients were therefore included in the study. Six hundred of these patients responded giving a response rate of 63%. Two hundred and sixty-seven patients (45% of responders) report suffering with pain caused by their thoracic surgery with an overall prevalence of 45.4% for thoracotomies and 40.7% for VATS.

The patient characteristics are shown in Table 2. This also shows the characteristics of the group that failed to respond. The responder group (n = 600) and the non-responder group (n = 348) were compared to assess whether they were comparable. Significance was taken as p < 0.05. The non-responder group are significantly more likely to be male, to be younger, to have a lower BMI, to have had their operation less recently, to have had a benign pleural operation and less likely to have had a malignant lung operation. The non-responders are also more likely to have undergone a VATS surgical procedure, though this is not significant. Therefore, the responders do not appear to be representative of the whole study population.

Within the responder group those who report pain (n = 267) were compared to those who did not report pain (n = 333). Multivariate logistic regression analyses were performed adjusting for age, BMI, sex, consultant, time since the operation, diagnosis and surgical approach (Table 3). Data are presented as odds ratio (OR), 95% confidence intervals (CI) when appropriate and with p-values. This analysis indicates for every year increase in age the likelihood of pain decreases by 2%, the consultant has a significant effect, and for every year increase in time since the operation the likelihood of pain decreases by 17%. Although the likelihood of pain is 18% higher for females and 32% lower for VATS, these are not statistically significant. The relationship between the prevalence of pain and consultant is shown in Fig. 2 and indicates that consultant C is associated with less pain (35.2%) compared to consultant D (58.7%) and this is significant (p < 0.001). The trend for the prevalence of pain to fall with time since the operation is shown in Fig. 3. Further analysis comparing specific proportions of malignant versus benign diagnoses and comparing lung versus pleural versus oesophageal diagnoses shows no significant association with pain (p = 0.6 and p = 0.7, respectively).

Their responses to the questionnaire (Table 4) show 7.9% reported their pain is severe and 60.3% felt improvement in their pain over time. In assessment of the impact of their

| Table 2 | Patient characteristics of responders and non-responders |
|---------------------------------------------------------------|
| **Responder Group (n = 600)** | **Non-responder Group (n = 348)** | **p value** |
| Male sex (%) | 56.3 | 63.8 | 0.03 |
| Mean age (range) (years) | 55 (14–85) | 50 (14–86) | <0.001 |
| Body mass index | 26.5 | 25.4 | 0.04 |
| Time since the operation | | | 0.001 |
| Consultant (%) | | | 0.3 (NS) |
| A | 29.2 | 26.1 | |
| B | 14.3 | 18.7 | |
| C | 35.5 | 35.3 | |
| D | 21.0 | 19.8 | |
| Surgical approach (%) | | | 0.3 (NS) |
| Thoracotomy | 80.3 | 77.0 | |
| VATS | 19.7 | 23.0 | |
| Diagnosis (%) | | | <0.001 |
| Malignant lung | 35.5 | 24.4 | |
| Benign lung | 19.0 | 15.5 | |
| Malignant oesophagus | 4.0 | 6.0 | |
| Benign oesophagus | 14.0 | 14.4 | |
| Trauma | 2.2 | 1.4 | |
| Malignant pleural | 1.2 | 2.0 | |
| Benign pleural | 22.0 | 34.5 | |
| Other | 1.7 | 1.7 | |
pain: 39.2% take analgesia, 45.5% feel it is their worst medical problem and 39.7% reported it limits their daily activities. Fifteen percent have attended a specialist pain clinic.

Analyses were performed to try to identify any patient characteristic, diagnosis or operative factor that could predict whether a patient is likely to have severe pain (compared to mild or moderate pain), to take analgesia, that their pain is their worst medical problem or that their daily activities are limited by pain (questions 15, 16, 18 and 20, respectively). Multivariate logistic regression analysis was used adjusting for sex, age, consultant, time since the operation, BMI, diagnosis and surgical approach. The only significant finding is that analgesia users are more likely to be younger by on average 3 years compared to non-users.

Analyses comparing the specific proportions of pleural versus lung versus oesophagus diagnoses and benign versus malignant diagnoses were also performed. Comparison of pleural versus pulmonary versus oesophageal diagnoses shows no significant association with any of the factors. Comparison of malignant versus benign diagnoses does show that malignancy is associated with a significantly higher proportion of analgesia use (51% vs 31%, p = 0.03), although there is no significant association with pain severity, pain being the worst problem or pain limiting daily activity. Increasing time since the operation does not appear to be associated with prevalence of analgesia use (p = 0.3), the number of different types of analgesia in use or the type of analgesia in use (p > 0.05).

The prevalence of each neuropathic symptom is between 35.2 and 82.8%. For each neuropathic symptom, a multivariate logistic regression analysis was performed comparing the presence of the neuropathic symptom with its absence. This showed no significant association for sex, age, consultant, time since the operation, BMI, diagnosis and surgical approach for any of the symptoms. x² analyses were performed to investigate any association between the presence of neuropathic symptoms (questions 4, 5, 6, 7 and 8) and pain severity, analgesia use, pain being the worst medical problem and daily activities being limited by pain (questions 15, 16, 18 and 20, respectively). This is shown in Table 5, with p-values < 0.05 being significant. This demonstrates that, with the exception of affected skin being abnormally sensitive to touch, the presence of a neuropathic symptom is associated with significantly more severe pain, more analgesia use and pain more likely to limit daily activity. Skin looking different and abnormal skin temperature are also associated with the likelihood of pain being the worst medical problem. There is no association between prevalence of the neuropathic symptom groups and increasing time since the operation. The relationship between the presence of a neuropathic symptom and whether patients felt their
pain had improved over time was assessed and found not to be significant for any of the symptoms. All symptoms, except abnormally sensitive to touch, reduce the likelihood of having improvement, though only skin looking different is significant: 67% versus 49% ($p = 0.03$).

4. Discussion

The authors believe this is the largest study investigating chronic pain after thoracic surgery and one of a very few looking at the neuropathic aspect of this type of chronic pain. Other strengths include the fact that the basis for the questionnaire is an inquiry of current symptoms rather than symptoms the patient may have experienced in the past that are difficult to recall. By targeting patients over a considerable time period since their operation it does allow us to build up a sense of how symptoms change with time. This is important for informing chronic pain sufferers, considering treatment options and assessing treatment efficacy. Our prospectively gathered thoracic surgery database is a powerful tool having had data entered rigorously for 14 years. It has a large number of parameters for each individual though we have only used those we thought were relevant to chronic pain.

The specific questions we used on neuropathic symptoms have only been validated in the LANSS Pain Scale. This tool also involves the examination of the patient. We recognise these questions have not been validated for use in our questionnaire. Questionnaires are often hampered by poor response rates but we believe 63% is sufficient to give this study credibility. Although the responders make up the majority, they were not representative of the study group as a whole. We expected the non-responders would tend to be young males, who underwent VATS procedures for benign disease, a long time ago, because this group is more likely to have moved away, be too busy or are less inclined to complete a questionnaire.

Overall prevalence of chronic pain found in the study for thoracotomy (45%) and VATS (41%) is comparable with the published studies. However, we realise our study may over-report pain since people with pain are more likely to respond to our questionnaire than people without pain. A trend for the prevalence of pain to fall with time since the operation is expected (Fig. 3), and may be due to a resolution of the painful process peripherally or because of gradual lessening of pain perception centrally. This finding is useful for explaining to chronic pain sufferers that symptom prevalence does fall with time.

From the comparison of the pain with the no-pain groups an average decrease in prevalence (of 17%) per year after the operation is expected. The fall in prevalence with increasing age may be explained by the elderly having less intense inflammatory responses to surgery that may trigger chronic pain syndromes, they may be more tolerant of pain, have lower expectations of pain control or be taking pain-modifying drugs for other comorbidities. This is supported by our finding that patients who take analgesia specifically for their thoracic surgery pain tend to be younger. The significant finding that consultants have an effect on prevalence of chronic pain may be the result of differences in intra-operative technique, anaesthesia, method of post-operative analgesia, influence of trainees and style of explanation that prepares the patient for surgery. The evidence that there is no significant difference between VATS and thoracotomy supports previous studies [1,2]. There was no difference between malignant and benign diagnoses, although we were unable to exclude patients with recurrent disease: a factor highlighted in the literature [14]. We also found those patients with malignant diagnoses were more likely to be analgesia users, which may be because they need more pain control or because it is more acceptable to prescribe long-term analgesia to patients with malignancy.

In the pain group, the proportions of mild, moderate and severe pain were expected, but the absence of a trend of pain severity lessening with time was surprising. Just 60% reporting improvement in their pain over time was unexpectedly low. The significant impact of pain on patients’ lives is well illustrated by around 40% taking analgesia, having pain as their worst problem and pain limiting their daily activities, and this supports the need for further research into the prevention and treatment of chronic pain following thoracic surgery.

With the exception of skin being abnormally sensitive to touch, the presence of neuropathic pain symptoms was associated with pain that is more severe, less likely to improve with time and has a greater impact on patients’ lives: more analgesia use, pain limiting daily activities and pain being their worst medical problem. As the overall prevalence of chronic pain falls with time, the frequencies of neuropathic symptoms within the pain group did not change significantly. This suggests neuropathic symptoms tend to persist but become less troublesome with time.

5. Conclusion

Chronic pain after thoracic surgery is a significant problem that affects a considerable proportion of patients and can impact upon patients’ lives for several years. Our study shows that in our unit this is influenced by patient age, operating consultant and time since the operation. The influence of
consultant requires particular emphasis as this is an area that can be more closely investigated and techniques that reduce chronic pain can be sought. Neuropathic symptoms representing nerve dysfunction and damage are associated with more severe chronic pain and greater impact on patients’ lives, and tend to persist.

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References