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The physiotherapy management of patients undergoing thoracic surgery: a survey of current practice in Australia and New Zealand

JULIE REEVE School of Physiotherapy, Faculty of Health and Environmental Studies, Auckland University of Technology, Auckland, New Zealand
LINDA DENEHY Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne, Melbourne, Australia
KATHY STILLER Royal Adelaide Hospital, Adelaide, South Australia

ABSTRACT **Background and Purpose.** *Physiotherapy is considered an essential component of the management of patients after thoracotomy, yet the type of interventions utilized, and evidence for their efficacy, has not been established. The aim of the present study was to ascertain the current physiotherapy management of patients undergoing thoracotomy and the factors influencing practice among different providers.* **Method.** *A purpose-designed postal questionnaire was distributed to senior physiotherapists in all thoracic surgical units throughout Australia and New Zealand (n = 57).* **Results.** *A response rate of 81% was obtained (n = 46). Pre-operatively, 16 respondents (35%) reported assessing all thoracotomy patients. The majority of respondents (n = 44; 96%) indicated that all patients were seen by physiotherapists after surgery, with 29 respondents (63%) performing prophylactic physiotherapy interventions to prevent post-operative pulmonary complications. Respondents reported that physiotherapy treatment was usually commenced on day one post-operatively (n = 37; 80%) with the most commonly used treatment interventions being deep breathing exercises, the active cycle of breathing techniques, cough, forced expiration techniques and sustained maximal inspirations. Most respondents reported that patients first sat out of bed (n = 41; 89%), commenced shoulder range of movement (n = 23; 50%) and walking (n = 32; 70%) on day one post-operatively. The majority of respondents reported that they offered no post-operative pulmonary rehabilitation (n = 25; 54%), outpatient follow-up (n = 43; 94%) or post-thoracotomy pain management (n = 40; 87%). Respondents indicated that personal experience, literature recommendations and established practice were the factors which most influenced physiotherapy practice.* **Conclusion.** *Most patients after thoracotomy receive physiotherapy assessment and/or treatment in the immediate post-operative period, but only one-third were routinely seen pre-operatively and relatively few were reviewed following discharge from hospital. Further studies are required to guide*

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physiotherapists in determining the efficacy of their practices for patients undergoing thoracotomy. Copyright © 2007 John Wiley & Sons, Ltd.

Key words: physiotherapy, survey, thoracic surgery

INTRODUCTION

Thoracic surgery has developed extensively over the past 50 years, with recent developments including lung transplantation, video assisted thoracoscopic surgery (VATS) and lung volume reduction surgery. In the United Kingdom in 1999/2000 there were 10,500 lung operations for all types of respiratory disease (British Thoracic Society, 2001). Berrisford et al. (2005) report that of 3426 lung resections performed in 27 European centres, 2379 were for lung cancer. Although similar data regarding the number of lung operations in Australia and New Zealand are not readily available, it is likely that the number is high, given that lung cancer was the third most common adult cancer in Australia in 2001 (Australian Institute of Health and Welfare, 2006) and there are over 1500 new cases of lung cancer reported in New Zealand per year (New Zealand Health Information Services, 2006).

The physiotherapy management of patients after major surgery forms the basis of much debate among physiotherapists worldwide. A growing number of studies have investigated both current practice and the effectiveness of physiotherapy treatments in patients undergoing cardiac and upper abdominal surgery, and findings suggest that routine physiotherapy interventions beyond positioning and early mobilization may be unnecessary (Jenkins et al., 1989, 1990; Stiller et al., 1994, 1995, 1997; de Charmoy and Eales, 2000; Pasquina et al., 2003; Mackay et al., 2005). This has enabled physiotherapists to re-evaluate traditional treatment programmes and consider changes in practice. To date, however, there has been little research investigating the physiotherapy management of patients undergoing thoracic surgery. Post-operative pulmonary complications, pain and shoulder dysfunction have been widely reported following thoracic surgery, and physiotherapy interventions which aim to remediate these problems have been strongly advocated despite a lack of strong supporting evidence (Stephan et al., 2000; Li et al., 2004). The incidence of post-operative pulmonary complications in this group ranges from 8% (Gosselink et al., 2000) to 36% (Issa et al., 1991) and with physiotherapy costs approximated at €407 per treated patient after thoracic surgery (Varela et al., 2006), the necessity to demonstrate the efficacy of interventions is paramount. In preparation for a future study investigating the efficacy of routine physiotherapy interventions following thoracic surgery, it seems timely that current physiotherapy interventions for patients undergoing thoracic surgery are investigated.

Thus, the aims of the present study were to review the overall provision of services by physiotherapists for patients undergoing thoracic surgery, specifically by:

- surveying current physiotherapy practice in thoracic units throughout Australia and New Zealand
- identifying what interventions physiotherapists use in the management of patients following thoracic surgery
- identifying variability of service provision throughout Australia and New Zealand

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- determining factors that influence physiotherapy service provision for patients undergoing thoracic surgery.

METHOD

Hospitals throughout Australia and New Zealand expected to provide thoracic surgical services were identified from:

- direct communication with the Thoracic Society of Australia and New Zealand
- an internet search of all hospitals with cardiothoracic surgical facilities throughout Australia and New Zealand
- personal telephone or email contact with leading physiotherapy clinicians and educators throughout every Australian state and in all hospitals with intensive care facilities in New Zealand
- personal telephone contact and verification with senior physiotherapy clinicians in hospitals where thoracic surgery was deemed possible but no verification could be found by other means.

As no validated tool currently existed to survey physiotherapy practice about thoracic surgery, a questionnaire was designed for the purpose. The questionnaire sought information about service provision, pre- and post-operative physiotherapy management, physiotherapy following discharge from hospital and factors influencing physiotherapy service provision. The use of experts in the field, previous similar surveys and a pilot questionnaire conducted at three different international sites were used to develop a broad range of questions and ensure face, construct and content validity of the survey. Respondents were asked to comment on 'open thoracotomy management only' except where stated. The questionnaire was divided into four sections with 26 questions in total. For ease of completion and analysis a majority of closed questions were utilized but respondents were asked to comment if they considered it necessary.

A pilot study was conducted at two sites in Australia and one in New Zealand. Comments on question design, ambiguities, terminology differences between countries, structure, flow and content were sought and minor changes made.

The questionnaire was then distributed to the 'senior physiotherapist' of all identified thoracic surgical units throughout Australia and New Zealand. A covering letter explained the purpose of the questionnaire, identified the researchers and assured confidentiality. Four weeks were allowed for return of the questionnaire and repeat questionnaires were sent by mail to non-responders. Responses were only available to the researchers and all data received were kept in a locked cabinet. Return of the questionnaire was taken to represent informed consent.

Ethical permission was granted from the University of Melbourne, Victoria, Australia and Auckland University of Technology, Auckland, New Zealand ethics committees.

Data analysis

All closed data were of the nominal/ordinal form and were analysed by use of SPSS Version 11.5 for Windows using a variety of descriptive statistical methods. Open data were analysed by content analysis and development of themes.

RESULTS

Response rate

A total of 61 questionnaires were distributed. Two hospitals to whom questionnaires

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were distributed provided no thoracic surgery and two questionnaires were inadvertently repeated administrations. Thus, the actual valid number of questionnaires distributed was 57. A response rate of 80.7% was obtained, with 46 of the 57 distributed questionnaires being returned completed and one uncompleted (thereby refusing consent). Demographic data from the units surveyed are given in Table 1. Most respondents (n = 26; 56.5%) reported their units undertook between one and five open thoracic surgical procedures per week with open pulmonary resection and pleural surgery the most common procedures undertaken.

Pre-operative physiotherapy management

Pre-operatively, 16 respondents (34.8%) reported that all patients were seen on a face-to-face basis, 19 (41.3%) reported that only *some* patients were seen pre-operatively (usually based on risk assessment) and 11 (23.9%) reported seeing no patients before surgery. Of those who stated that they did not offer pre-operative physiotherapy, the reasons given were lack of time (n = 5), insufficient evidence to support pre-operative physiotherapy (n = 4) or that information was provided by other means or by other staff (n = 4).

Of the 35 instances where some or all patients were reported as being seen pre-operatively by a physiotherapist, the patients were all assessed on a face-to-face basis, with 18 respondents reporting this was supplemented with written information. Three respondents reported that patients were seen in groups as well as individually. Components of the pre-operative physiotherapy assessment are shown in Figure 1 and the

TABLE 1: Demographic data

Number of patients undergoing open thoracotomy (per week)	*n (%)*
<1	15 (32.6)
1–5	26 (56.5)
6–10	4 (8.7)
>10	1 (2.2)
Type of surgery	*n (%)*
Pulmonary resection	44 (95.7)
Pleural surgery	43 (93.5)
Video-assisted thoracoscopic surgery	40 (87.0)
Oesophageal	25 (54.3)
Chest wall reconstruction	18 (39.1)
Lung volume reduction surgery	17 (37.0)
Other	6 (13.0)
Average post-operative length of stay (days)	*n (%)*
0–3	1 (2.2)*
4–7	37 (80.4)
8–10	6 (13.0)
>10	1 (2.2)
Missing data	1 (2.2)

* Undertakes video-assisted thoracoscopic surgery and pleural surgery only.

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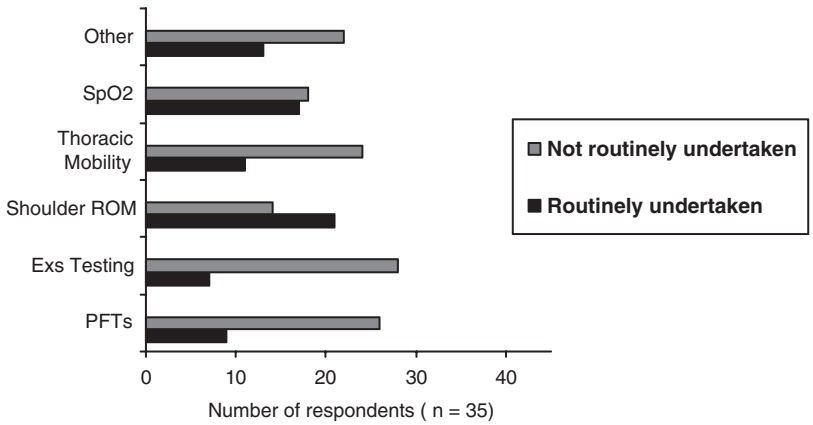

FIGURE 1: Pre-operative physiotherapy assessment procedures routinely undertaken by physiotherapists. SpO_2 = percutaneous oxygen saturation; ROM = range of movement; Exs = exercise; PFT = pulmonary function test.

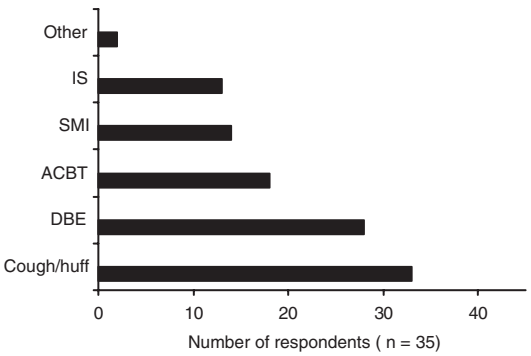

FIGURE 2: Respiratory physiotherapy interventions routinely taught pre-operatively. IS = incentive spirometry; SMI = sustained maximal inspiration; ACBT = active cycle of breathing techniques; DBE = deep breathing exercises.

most common respiratory manoeuvres taught pre-operatively are shown in Figure 2.

The majority of pre-operative assessments ($n = 21$) were performed by physiotherapists after patients' admission to hospital, with only five respondents' of reporting seeing patients in a pre-admission clinic and nine seeing patients both before and after admission to hospital.

Only 11 respondents (23.9%) reported that pre-operative pulmonary rehabilitation was carried out, and in all cases this was undertaken for lung volume reduction surgery or lung transplant patients only. One respondent reported using pre-operative inspiratory muscle training.

Post-operative physiotherapy management

Following surgery, 45 of the 46 respondents (97.8%) reported that all patients were routinely seen by physiotherapists, with 29 respondents (63.0%) indicating that they treated all patients prophylactically, regardless of assessment findings.

In the majority of cases ($n = 37$; 80.4%), respondents reported that patients were first seen by a physiotherapist on post-operative day one, although several respondents indicated that patients were routinely treated on the day of surgery where the timing of surgery allowed this. Figure 3 illustrates the interventions undertaken by physiotherapists post-operatively on a 'normal' basis and those interventions considered to be contraindicated.

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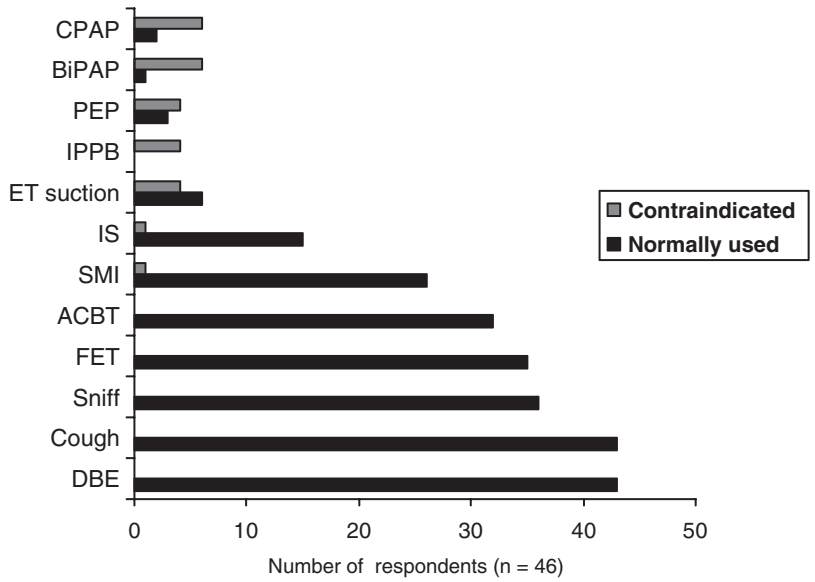

FIGURE 3: Respiratory physiotherapy interventions normally used or considered to be contraindicated post-operatively. CPAP = continuous positive airway pressure; BiPAP = bi-level positive airway pressure; PEP = positive expiratory pressure; IPPB = intermittent positive pressure breathing; ET suction = endotracheal suction; IS = incentive spirometry; SMI = sustained maximal inspiration; ACBT = active cycle of breathing techniques; FET = forced expiration technique; DBE = deep breathing exercises.

Table 2 shows mobilization activities undertaken, their timing and the staff who instigated them. The majority of respondents reported that physiotherapists were the healthcare workers who routinely instituted ambulation, stair-climbing, shoulder and thoracic mobility exercises in this patient group. However, 10 respondents (21.7%) reported that thoracic mobility exercises were not normally undertaken and 16 respondents (34.8%) reported not routinely giving discharge booklets or practising stair-climbing. Respondents were also asked on which day they first commenced these interventions and these results can also be seen in Table 2.

Several respondents ($n = 10$; 21.7%) noted that the presence of intercostal drains delayed shoulder and thoracic mobilization activities and 27 respondents (58.7%) indicated that the presence of a persistent air leak altered physiotherapy management. Widely divergent strategies emerged when a persistent air leak was present; these included 'institution of incentive spirometry' to 'forbidden incentive spirometry', 'use of FET [forced expiration technique] but no cough' to 'no use of FET' and 'thoracic mobility exercises with prolonged stretch with the chest drain *in situ*' to 'restricted chest mobilization because of the presence of chest drains'. Most frequently ($n = 16$; 34.8%), physiotherapists reported altering their treatments for patients with persistent air leak to 'on the spot ambulation only', indicating that the need for continuous wall suction for persistent air leak management restricted ambulation activities. The use of positive pressure devices was reported as being restricted or forbidden by eight respondents (17.4%) in any patient demonstrating a persistent air leak.

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TABLE 2: Mobilization interventions undertaken, staff undertaking them and post-operative day interventions commenced

Intervention	*Physiotherapist, n (%)*	*Nurse, n (%)*	*Both/either, n (%)*	*Not routinely undertaken, n (%)*	*Day commenced, Mode (range)*
Sit out of bed	16 (34.8)	7 (15.2)	23 (50.0)	0 (0.0)	1 (0–1)
Ambulation	33 (71.7)	2 (4.3)	10 (21.7)	0 (0.0)	1 (0–2)
Shoulder ROM exercises	43 (93.5)	1 (2.2)	0 (0.0)	2.43	1 (0–7 or on ICD)
Thoracic mobility exercises	34 (73.9)	0 (0.0)	1 (2.2)	10 (21.7)	2 (1–5 or on ICD)
Stair-climbing	30 (65.2)	0 (0.0)	0 (0.0)	16 (34.8)	4 (3–7 or on discharge)
Discharge booklet	11 (23.9)	12 (26.1)	6 (13.0)	16 (34.8)	On discharge

ROM = range of movement.
ICD = intercostal drain removal.

scopic surgery (VATS) was reported as being consistently different to that of open thoracotomy by 40 respondents (87.0%). Consistent themes were of faster mobilization, significantly reduced physiotherapy input (often assessment only) and faster discharge from hospital. Four of the 46 respondents reported merely screening the case notes with all other respondents making routine face-to-face contact with patients undergoing VATS.

Only three respondents (6.5%) indicated that their physiotherapy management of patients after open pleural surgery differed from that following pulmonary resection. Most respondents (n = 34; 73.9%) reported that mini-tracheostomy was never used to assist with secretion removal, the remaining respondents (n = 12; 26.1%) indicated that it was only rarely used.

Post-discharge physiotherapy management

Table 3 shows the post-hospital discharge physiotherapy management for patients after thoracic surgery. Just over half of respondents (n = 25; 54.3%) reported that they offered no post-operative pulmonary rehabilitation after hospital discharge, and relatively few respondents offered physiotherapy review, treatment of post-thoracotomy pain or treatment of ongoing problems after discharge from hospital. Of those offering therapy for post-thoracotomy pain, treatment included scar tissue mobilization, thoracic mobility exercises and transcutaneous electrical nerve stimulation (TENS).

Research awareness and factors influencing physiotherapy service provision

Respondents were asked which literature (if any) had influenced their physiotherapy management of patients undergoing thoracic surgery. The majority of the 46 respondents (n = 29; 63.0%) failed to respond to this question, 11 respondents (23.9%) named specific papers or texts, two (4.3%) were aware of literature but unable to specifically name it and four (8.7%) stated that they were unaware of the literature. Of the 11 respondents able to name literature, seven respondents cited physiotherapy text books as a main source of evidence and eight

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TABLE 3: Post-hospital discharge physiotherapy management for patients after thoracic surgery

Post-hospital discharge pulmonary rehabilitation	*n (%)*
Yes, for all patients	4 (8.7)
Yes, for some patients only	17 (37.0)
No	25 (54.3)
Post-hospital discharge outpatient physiotherapy follow-up	*n (%)*
Yes, for all patients	0 (0.0)
Yes, for some patients only	3 (6.5)
No	43 (93.5)
Physiotherapy involvement in post-thoracotomy pain management	*n (%)*
Yes	6 (13.0)
No	39 (84.8)
Missing data	1 (2.2)

TABLE 4: Factors influencing physiotherapy service provision

Influencing factor, n (%)	*1 (No influence at all)*	*2*	*3*	*4*	*5 (Very influential)*
Personal experience	1 (2.2)	1 (2.2)	7 (15.2)	22 (47.8)	14 (30.4)
Literature recommendations	0 (0.0)	1 (2.2)	14 (30.4)	21 (45.7)	9 (19.6)
Established practice	1 (2.2)	3 (6.5)	15 (32.6)	17 (37.0)	8 (17.4)
Anaes/surgical preferences	3 (6.5)	7 (15.2)	13 (28.3)	15 (32.6)	7 (15.2)
Staffing numbers/caseload	7 (15.2)	9 (19.6)	13 (28.3)	9 (19.6)	7 (15.2)
Resource consideration	8 (17.4)	11 (23.9)	12 (26.1)	8 (17.4)	5 (10.9)
Contractual obligation	25 (54.3)	7 (15.2)	6 (13.0)	4 (8.7)	2 (4.3)
Peer pressure	23 (50.0)	14 (30.4)	6 (13.0)	2 (4.3)	0 (0.0)
Public/private patient	39 (84.8)	3 (6.5)	2 (4.3)	1 (2.2)	0 (0.0)
Other	2 (4.3)	0 (0.0)	0 (0.0)	1 (2.2)	3 (6.5)

respondents cited work in the cardiac or general surgical arena rather than in thoracic surgery.

Respondents were asked to rank (on a five-point Likert scale) which factors had most influenced their service provision. The results are shown in Table 4.

DISCUSSION

The response rate to this survey is considered excellent and therefore it is likely that results reflect the practice of the population studied (Portney and Watkins, 1993). The results of the survey can be used as a guide for physiotherapists in measuring their practices against those of other providers and as a relevant starting point for future studies investigating the efficacy of physiotherapy interventions in this patient population.

Pre-operative physiotherapy

The importance of pre-operative education on improving quality of care, post-operative recovery and pulmonary function is docu-

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mented throughout nursing and medical literature yet there are limited data to support its effectiveness. Thoren (1954), Bourne et al. (1991), Olsen et al. (1997) and Denehy (2001) all found reductions in the incidence of post-operative pulmonary complications following upper abdominal surgery in patients who underwent pre-operative physiotherapy education. Conversely, in cardiac surgery, studies have investigated pre- and post-operative physiotherapy interventions together rather than in isolation (Jenkins, 1991; Johnson et al., 1995; Brasher et al., 2003) with no evidence to support its value in the reduction in post-operative pulmonary complications. Thus, the role of pre-operative physiotherapy in patients undergoing major surgery, including thoracic surgery, remains to be fully determined. The current study found that the majority of respondents chose to see only some patients pre-operatively and usually based this on assessment of risk. This is similar to surveys of pre-operative physiotherapy in other surgical groups (Tucker et al., 1996; Mackay and Ellis, 2002; Reeve and Ewan, 2005). Given the associated costs of pre-operative physiotherapy interventions and the lack of evidence to date, the efficacy of pre-operative physiotherapy intervention requires investigation.

Post-operative physiotherapy

Although post-operative physiotherapy in other major surgical groups has been extensively investigated, there is a paucity of literature investigating the physiotherapy management of patients following thoracic surgery. Despite emerging evidence that physiotherapy management after routine upper abdominal and cardiac surgery, beyond early mobilization, may not confer any added benefit in the treatment of post-operative pulmonary complications (Pasquina et al., 2003; Mackay et al., 2005), the majority of physiotherapists continue to assess and treat most patients after major surgery, many continuing to focus on lung expansion manoeuvres (Tucker et al., 1996; Reeve and Ewan, 2005). Similarly, this study determined that following thoracic surgery the majority of physiotherapists continue to treat patients prophylactically, focusing on lung expansion and airway clearance manoeuvres, commencing these at an early stage post-operatively. Whether this level of intervention is necessary in this patient group remains to be determined. Evidence from a recent cross-sectional study with historical controls in patients after lung resection suggests that physiotherapy may reduce length of hospital stay and incidence of atelectasis (with a subsequent reduction in hospital costs) but appears to have no influence over the incidence of pneumonia and overall morbidity (Varela et al., 2006). Adequately powered randomized controlled trials, whilst difficult, need to be undertaken to fully determine the effect of physiotherapy on post-operative recovery and complications after thoracic surgery and lung resection. Evidence that incentive spirometry offers no additional benefit to reduction of post-operative pulmonary complications in patients undergoing thoracic surgery (Gosselink et al., 2000) or other forms of major surgery (Overend et al., 2001) has been demonstrated. Despite this, the provision of incentive spirometry is widely practised both before and after thoracic surgery with up to one-third of respondents in the present study reporting utilizing incentive spirometry as a 'normal' intervention. Respondents indicated that personal experience, established practice, surgical colleague's preferences and literature recommendations were the factors that most

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influenced the provision of their physiotherapy services; however, few respondents could specifically identify literature informing their practice.

This survey identified repetition or overlap of treatment strategies, advice and education between nursing staff, physiotherapists and/or other health professionals similar to that seen in other post-surgical groups (Reeve and Ewan, 2005). This duplication of roles may be beneficial to patient care in that it reinforces information and promotes recovery but, conversely, should be closely scrutinized to ensure necessity, consistency and cost-effectiveness. The variations in some aspects of post-operative physiotherapy practice were surprising and, given that the preferences of surgical/anaesthetic colleagues had a strong influence on physiotherapy practice, this may reflect differences in surgeon's instructions.

Persistent air leak is the most common condition that causes prolonged length of hospital stay and adds significantly to hospital costs after thoracic surgery (Loran et al., 2002; Varela et al., 2005). The optimal management of intercostal drains and persistent air leaks, including physiotherapy interventions, currently forms the basis for much debate (Cerfolio et al., 2002). Clarification of whether and how physiotherapy interventions affect persistent air leaks may assist in optimizing their management and potentially reducing hospital costs.

Although the majority of respondents in the present survey indicated that minitracheostomy was rarely or never used, studies by Bonde et al. (2002) and Issa et al. (1991) report the use of prophylactic minitracheostomy to be safe and effective in decreasing the incidence of post-operative respiratory complications in patients undergoing lung surgery.

The role of rehabilitation and post-discharge physiotherapy

The current study found marked differences in the type of rehabilitative strategies (beyond management of post-operative pulmonary complications) that were offered. Written exercise or home advice, thoracic mobility exercises and stair-climbing practice varied widely in their provision and timing. The wide range in the post-operative day on which these activities were commenced may be an indication of surgeons' preference. Any future studies considering the efficacy of these interventions should state when activities were commenced and report adverse events to clarify if, and at what point, these interventions are necessary.

Recently, focus has been placed on the potential of both pre- and post-operative rehabilitation to improve post-operative function and quality of life (Celli, 2004). The role of pre-operative rehabilitation for patients undergoing lung resection via open thoracotomy is currently unclear, with only a few or small randomized controlled trials undertaken (Takaoka, 2005). Sekine et al. (2005) found post-operative length of stay to be reduced and forced expiratory volume in one second (FEV_1) to be better preserved in lung cancer patients with chronic obstructive pulmonary disease (COPD) undergoing pre-operative rehabilitation. In the current survey, only 11 respondents reported that pre-operative pulmonary rehabilitation was conducted and in all cases this was only for patients undergoing lung volume reduction surgery (LVRS) or transplantation. Reasons for this may include the need to minimize delay between diagnosis and surgical intervention in patients presenting with lung cancer, that access to pulmonary rehabilitation programmes is limited, that there is

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little evidence to support pre-operative rehabilitation in patients presenting for lung resection and a limited knowledge of the existence or value of pre-operative pulmonary rehabilitation programmes by surgeons or physicians.

Few centres offered post-thoracotomy pulmonary rehabilitation, and where offered this was mostly reserved for patients undergoing LVRS or lung transplantation. Handy et al. (2002) suggested the impact of restorative surgery (such as LVRS) on functional health status may differ from those patients undergoing lung resection for carcinoma and that this needs to be more fully investigated. Certainly, post-operative cardiopulmonary function and exercise capacity have been examined after pulmonary resection and demonstrated to be persistently decreased by pneumonectomy (Larsen et al., 1997; Nugent et al., 1999). Handy et al. (2002) demonstrated significant post-operative physical, emotional, social and mental disabilities in patients undergoing lung resection for cancer and thus suggested pulmonary rehabilitation to ameliorate the deleterious effects of both the underlying cancer and the effect of surgery. Further studies to investigate the efficacy of exercise rehabilitation in this patient group should be undertaken.

Shoulder dysfunction after thoracic surgery is a commonly overlooked complication and whilst the exact prevalence is poorly defined, it is reported in up to 33% of patients one year after surgery (Landreneau et al., 1994; Li et al., 2003). Severe chronic post-thoracotomy pain has been noted in up to 67% of patients following thoracotomy and may also account for reductions in functional health status (d'Amours et al., 1998). While post-operative pain may have considerable overlap with post-operative shoulder dysfunction (Landreneau et al., 1998) the precise relationship between pain and shoulder dysfunction remains elusive (Li et al., 2004).

Physiotherapy has been advocated to remediate these problems (Li et al., 2004) yet, to date, no study has investigated the effectiveness of physiotherapy in this area. Future studies to investigate the efficacy of physiotherapy to prevent and remediate both post-thoracotomy pain and shoulder dysfunction should be undertaken.

Limitations

Although the present study aimed to survey current physiotherapy practice and identify factors influencing service provision for patients undergoing thoracic surgery, it is acknowledged that factors pertaining to individual patient requirements (e.g. their clinical condition and responses to treatment) may also influence physiotherapy interventions and were not addressed. Additionally, this study did not attempt to determine the quality of practice nor any attitudes, beliefs or concerns about practice from the respondents. Furthermore, the study sought responses from only one respondent per surgical unit and it is acknowledged that individual physiotherapists may have responded differently.

IMPLICATIONS

The present study will enable clinicians to compare their management of patients after thoracic surgery against that of similar service providers and thus reflect on any differences in practice. It has highlighted the limitations of the evidence currently available to physiotherapists to guide their practice and calls for further studies to determine efficacy of all aspects of physiotherapy practices before and after thoracic surgery.

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CONCLUSION

This survey has documented current physiotherapy practices for thoracic surgical patients throughout Australia and New Zealand, and has demonstrated the widespread use of lung expansion and airway clearance manoeuvres and marked variations in some aspects of practice. This study has highlighted a need for research into all aspects of physiotherapy management for patients undergoing thoracic surgery in order to more clearly evaluate practice, including the role of pre- and post-operative rehabilitation and prophylactic post-operative physiotherapy for the management of pulmonary and musculoskeletal complications.

REFERENCES

Australian Institute of Health and Welfare (AIHW), Australian Association of Cancer Registries (AACR) and National Cancer Strategies Group (NCSG). Available from: www.aihw.gov.au/publications (accessed 28 August 2006).

Berrisford R, Brunelli A, Rocco G, Treasure T, Utley M. The European Thoracic Surgery Database project: modelling the risk of in-hospital death following lung resection. European Journal of Cardio-Thoracic Surgery 2005; 28: 306–311.

Bonde P, Papachristos I, McCraith A, Kelly B, Wilson C, McGuigan J et al. Sputum retention after lung operation: prospective randomised trial shows superiority of prophylactic minitrachesotomy in high risk patients. Annals of Thoracic Surgery 2002; 74: 196–203.

Bourne J, Conway J, Holgate S. The effect of post operative physiotherapy on pulmonary complications and lung function after upper abdominal surgery. European Respiratory Journal 1991; 4: S325.

Brasher PA, McClelland KH, Denehy L, Story I. Does removal of deep breathing exercises from a physiotherapy program including pre-operative education and early mobilisation after cardiac surgery alter patient outcomes? Australian Journal of Physiotherapy 2003; 49: 165–173.

British Thoracic Society. The Burden of Lung Disease. London: British Thoracic Society, 2001.

Celli BR. Chronic respiratory failure after lung resection: the role of pulmonary rehabilitation. Thoracic Surgery Clinics 2004; 14: 417–428.

Cerfolio RJ, Bass CS, Pask AH, Katholi CR. Predictors and treatment of persistent air leaks. Annals of Thoracic Surgery 2002; 73: 1727–1730.

d'Amours RH, Riegler FX, Little AG. Pathogenesis and management of persistent post thoracotomy pain. Chest Surgery Clinics of North America 1998; 8: 703–722.

de Charmoy SB, Eales CJ. The role of prophylactic chest physiotherapy after cardiac valvular surgery: is there one? South African Journal of Physiotherapy 2000; 56: 24–28.

Denehy L. The Physiotherapy Management of Patients Following Upper Abdominal Surgery. Unpublished doctoral thesis. University of Melbourne, Melbourne, Australia, 2001.

Gosselink R, Schrever K, Cops P, Witvrouwen H, De Leyn P, Troosters T et al. Incentive spirometry does not enhance recovery after thoracic surgery. Critical Care Medicine 2000; 28: 679–683.

Handy JR, Asaph JW, Skoken L, Reed CE, Koh S, Brooks G et al. What happens to patients undergoing lung cancer surgery? Outcomes and quality of life before and after surgery. Chest 2002; 122: 21–29.

Issa MM, Healy DM, Maghur HA, Luke DA. Prophylactic minitracheotomy in lung resections. A randomized controlled study. Journal of Thoracic and Cardiovascular Surgery 1991; 101: 895–900.

Jenkins S. Pre-operative and post-operative physiotherapy — are they necessary? In: J Pryor, B Webber (eds), Respiratory Care. London: Churchill Livingstone, 1991; 147–168.

Jenkins S, Soutar S, Loukota J, Johnson L, Moxham J. Physiotherapy after coronary heart surgery: are breathing exercises necessary? Thorax 1989; 44: 634–639.

Jenkins S, Soutar S, Loukota J, Johnson L, Moxham J. A comparison of breathing exercises, incentive spirometry and mobilisation after coronary artery surgery. Physiotherapy Theory and Practice 1990; 6: 117–126.

Johnson D, Kelm C, To T, Hurst T, Naik C, Gulka I et al. Postoperative physical therapy after coronary artery bypass surgery. American Journal of Respiratory and Critical Care Medicine 1995; 152: 953–958.

Landreneau RJ, Mack MJ, Hazelrigg SR, Naunheim K, Dowling RD, Ritter P et al. Prevalence of chronic pain after pulmonary resection by thoracotomy or video-assisted thoracic surgery. Journal of Thoracic and Cardiovascular Surgery 1994; 107: 1079–1086.

Landreneau RJ, Wiechmann RJ, Hazelrigg SR, Mack MJ, Keenan RJ, Ferson PF. Effect of minimally invasive thoracic surgical procedures on acute and chronic postoperative pain. Chest Surgery Clinics of North America 1998; 8: 891–906.

Larsen KR, Svensdsen UG, Milman N. Cardiopulmonary function at rest and during exercise after resec-

DOI: 10.1002/pri

tion for bronchial carcinoma. Annals of Thoracic Surgery 1997; 64: 960–964.

Li WWL, Lee RLM, Lee TW, Ng CSH, Sihoe ADL, Wan IYP et al. The impact of thoracic surgical access on early shoulder function: video-assisted thoracic surgery versus posterolateral thoracotomy. European Journal of Cardio-Thoracic Surgery 2003; 23: 390–396.

Li WWL, Lee TW, Yim APC. Shoulder function after thoracic surgery. Thoracic Surgery Clinics 2004; 14: 331–343.

Loran DB, Woodside KJ, Cerfolio RJ, Zwischenberger JB. Predictors of alveolar air leaks. Chest Surgical Clinics of North America 2002; 12: 477–488.

Mackay M, Ellis E. Physiotherapy outcomes and staffing resources in open abdominal surgery patients. Physiotherapy Theory and Practice 2002; 18: 75–93.

Mackay M, Ellis E, Johnston C. Randomised clinical trial of physiotherapy after open abdominal surgery in high risk patients. Australian Journal of Physiotherapy 2005; 51: 151–159.

New Zealand Health Information Services. National Cancer Registry and Statistics. Wellington: Ministry of Health. Available from: www.nzhis.govt.nz/Service_guide.html (accessed 18 September 2006).

Nugent AM, Steele I, Carragher A. Effect of thoracotomy and lung resection on exercise capacity in patients with lung cancer. Thorax 1999; 54: 334–338.

Olsen F, Hahn I, Nordgren S, Lonroth H, Lundholm K. Randomised controlled trial of prophylactic chest physiotherapy in major abdominal surgery. British Journal of Surgery 1997; 84: 1535–1538.

Overend TJ, Anderson CM, Lucy SD, Bhatia C, Jonsson BI, Timmermans C. The effect of incentive spirometry on postoperative pulmonary complications: a systematic review. Chest 2001; 12: 971–978.

Pasquina P, Tramer M, Walder B. Prophylactic respiratory physiotherapy after cardiac surgery: systematic review. British Medical Journal 2003; 327: 1373–1379.

Portney L, Watkins M. Foundations of Clinical Research. Applications to Practice. CT: Appleton & Lange, 1993.

Reeve J, Ewan S. The physiotherapy management of the coronary artery bypass graft patient: a survey of current practice throughout the United Kingdom. Journal of the Association of Chartered Physiotherapists in Respiratory Care 2005; 37: 35–45.

Sekine Y, Chiyo M, Iwata T, Yasufuku K, Furukawa S, Amada Y et al. Perioperative rehabilitation and physiotherapy for lung cancer patients with chronic obstructive pulmonary disease. Japanese Journal of Thoracic and Cardiovascular Surgery 2005; 53: 237–243.

Stephan F, Boucheseiche S, Hollande J, Flahault A, Cheffi A, Bazelly B et al. Pulmonary complications following lung resection: a comprehensive analysis of incidence and possible risk factors. Chest 2000; 118: 1263–1270.

Stiller K, Montarello J, Wallace M, Daff M, Grant R. Are breathing and coughing exercises necessary after coronary artery surgery? Physiotherapy Theory and Practice 1994; 10: 143–152.

Stiller K, Crawford R, McInnes M, Montarello J, Hall B. The incidence of pulmonary complications in patients not receiving prophylactic chest physiotherapy after cardiac surgery. Physiotherapy Theory and Practice 1995; 11: 205–208.

Stiller K, McInnes M, Huff N, Hall B. Do exercises prevent musculoskeletal complications after cardiac surgery? Physiotherapy Theory and Practice 1997; 13: 117–126.

Takaoka ST. The value of preoperative pulmonary rehabilitation. Thoracic Surgery Clinics 2005; 15: 203–211.

Thoren L. Post operative pulmonary complications: observations on their prevention by means of physiotherapy. Acta Chirugica Scandinavica 1954; CVII: 193–205.

Tucker B, Jenkins S, Davies K, McGann R, Waddell J, King R et al. The physiotherapy management of patients undergoing coronary artery surgery: a questionnaire survey. Australian Journal of Physiotherapy 1996; 42: 129–137.

Varela G, Jiménez MF, Novoa N, Aranda JL. Estimating hospital costs attributable to prolonged air leak in pulmonary lobectomy. European Journal of Cardio-Thoracic Surgery 2005; 27: 329–333.

Varela G, Ballesteros E, Jiménez MF, Novoa N, Aranda JL. Cost-effectiveness analysis of prophylactic respiratory physiotherapy in pulmonary lobectomy. European Journal of Cardio-Thoracic Surgery 2006; 29: 216–220.

Address correspondence to: Julie C Reeve MSc, Grad Dip Phys, MNZSP, Senior Lecturer in Physiotherapy, School of Physiotherapy, Faculty of Health and Environmental Studies, Auckland University of Technology, Auckland, New Zealand (E-mail: Julie.reeve@aut.ac.nz).