Frailty assessment in thoracic surgery

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Abstract

A best evidence topic in thoracic surgery was performed according to a structured protocol. The question addressed was the role of frailty scores in predicting outcomes of patients undergoing thoracic surgery. Seventy-one papers were found using the reported search, of which three studies and one conference abstract represented the best evidence to answer the clinical question. The authors, journal date, country of publication, patient group, study type, relevant outcomes and results are tabulated. Despite an extensive literature search, few studies were identified which addressed the clinical dilemma posed, all of which were retrospective observational series. A study analysed 971 434 patients across a wide range of surgical specialties, 4648 of which were classified as thoracic. A statistically significant relationship was demonstrated between increasing frailty and higher rates of postoperative complications and mortality \( (P < 0.0001) \). Another study reported a similar association between modified frailty index (mFI) scores and postoperative outcomes in patients undergoing lobectomies. Morbidity increased uniformly with mFI and multivariate analysis found an mFI of \( >0.27 \) \( (P = 0.002) \) to be an independent predictor of mortality. Another paper demonstrated higher rates of major postoperative complications and increased mortality \( (P < 0.001) \) in patients with higher preoperative dependency. A study examined geriatric frailty assessment tools for the prediction of postoperative outcomes in patients over 70 undergoing thoracic surgery for neoplasms. The Geriatric Depression Screen, Mini Mental State Examination, Fatigue Inventory, Eastern Co-Operative Oncology Group Performance Scale and Instrumental Activities of Daily Living were used as a means of determining preoperative frailty. Their conclusion supported the conclusions drawn from the larger studies that a single frailty measure alone did not predict an increase in morbidity or mortality, but in combination several measures may have a role in predicting postoperative outcomes. The clinical bottom line is that there is a paucity of evidence to either fully support or fully refute the use of preoperative frailty scoring as a reliable means of predicting morbidity and mortality in thoracic surgery. The evidence presented does however indicate the potentially important clinical role that frailty scores may have in the future.

Keywords: Frailty • Frailty index • Thoracic surgery • Risk stratification • Surgical outcomes

INTRODUCTION

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

THREE-PART QUESTION

In [patients undergoing thoracic surgery] do [frailty scores] act as a [good predictor of outcomes].

CLINICAL SCENARIO

In thoracic outpatient clinic, an 84-year old asks you the likelihood of a good postoperative outcome. Despite their frail appearance, tripartite assessment (incorporating lung function, cardiac risk factors and Thoracoscore) establishes a low surgical risk. You remain concerned however that their frailty will impact upon postoperative recovery. You resolve to determine whether a method incorporating frailty assessment exists to predict morbidity and mortality in these patients.

SEARCH STRATEGY

A search was performed using Medline from 1809 to 2013 via the PubMed interface with the search terms [thoracic surgery, frailty index, frailty, elderly, morbidity, mortality, outcomes limited to human studies].

SEARCH OUTCOME

Seventy papers were found using the reported search. Three papers and one conference abstract were identified that provided the best evidence to answer the question (Table 1).

RESULTS

Velanovich et al. [2] hypothesized that preoperative evaluation of frailty (including clinical history, physical examination, physical...
<table>
<thead>
<tr>
<th>Author, date journal, Study type (level of evidence)</th>
<th>Patient group</th>
<th>Outcomes</th>
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<tr>
<td>Velanovich et al. (2013), J Surg Res, USA [2]</td>
<td>Retrospective analysis (level 2b)</td>
<td>Retrospective analysis of 971,434 patients undergoing surgery; of which, 4648 were classified as having ‘general thoracic surgery’</td>
<td>Modified frailty index Postoperative complications (morbidity), including surgical site infection, empyema, pneumonia, urinary tract infection, reintubation, pulmonary embolism, failure to wean ventilation, renal failure and re-admission to ICU</td>
<td>Statistically significant relationship between a higher frailty index and increased risk of postoperative morbidity and mortality in mid- to high-complexity thoracic operations [P &lt; 0.0001]</td>
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<tr>
<td>Tsiouris et al. (2013), J Surg Res, USA [3]</td>
<td>Retrospective study (level 2b)</td>
<td>Retrospective study of 1940 patients who underwent lobectomy. A preoperative modified frailty index was derived based on the CHSA index</td>
<td>Modified frailty index Postoperative complications (morbidity) including surgical site infection, empyema, pneumonia, urinary tract infection, reintubation, pulmonary embolism, failure to wean ventilation, renal failure and re-admission to ICU</td>
<td>A modified frailty index (mFI) &gt;0.27 was associated with a 5.6% mortality rate [P = 0.001] Multivariant analysis showed that contaminated wounds and an mFI of &gt;0.27 [OR 4, CI 1.07–24, (P = 0.045) and (P = 0.002), respectively] were the strongest predictors of mortality Regressional analysis demonstrated that an mFI of &gt;0.27 [OR 4.9, CI 95% 1.3–230, (P = 0.027)] contaminated wounds [OR 4.8, CI 95% 1.2–53, (P = 0.028)], ASA grade 4 [OR 6.8, 95% CI 1.8–27, (P = 0.009)] and dependent functional status [OR 4.7%, CI 1.2–9.8, (P = 0.03)] were the main predictors of major complications</td>
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<tr>
<td>Tsiouris et al. (2012), J Surg Res, USA [4]</td>
<td>Retrospective analysis (level 2b)</td>
<td>Retrospective analysis of 6373 patients undergoing thoracic surgery. Preoperative functional status was measured and classified based on the ability to perform ADLs. Two groups were produced; independent and non-independent (5561 vs 812)</td>
<td>Functional status Postoperative complications (morbidity) including surgical site infection, empyema, pneumonia, urinary tract infection, reintubation, pulmonary embolism, failure to wean ventilation, renal failure and re-admission to ICU</td>
<td>Patients in the ‘dependent’ group were found to have higher rates of postoperative complications. In particular, prolonged ventilation was 9.3 times more likely ([P &lt; 0.001]), re-intubation was 3.1 times more likely ([P &lt; 0.001]) and mortality was 7.7 times higher ([P &lt; 0.001])</td>
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<td>Weigel et al. (2013), American Association for Thoracic Surgery Conference Abstract, USA [5]</td>
<td>Retrospective audit (level 2c)</td>
<td>Retrospective audit of 79 patients over the age of 70 undergoing thoracic surgery for neoplasms</td>
<td>Geriatric Depression Screen (GDS), Mini Mental State Examination (MMSE), Fatigue Inventory (FI), Eastern Co-Operative Oncology Group Performance Scale (ECOG PS) and assessment of ADLs and Instrumental Activities of Daily Living (ADLs)</td>
<td>No measured preoperative variable was able to predict postoperative outcomes</td>
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capability and comorbidities) could predict postoperative morbidity and mortality. Preoperative variables identified from the American College of Surgeons National Surgical Quality Improvement Programme (NSQIP) database were matched to variables from the Canadian Study of Health and Ageing Frailty Index, producing 11 matched items (Table 2), the number of positive items divided by 11 produced a modified frailty index (mFI).

The mFI was used to analyse a cohort of patients identified from the NSQIP database over a period of 4 years (2005–2009). Operative complexity in the cohort was categorized by development of work-relative units, assigning numerical values to the time, technical skill, physical/mental effort, judgement and psychological stress exerted by the operator for a procedure. A relative value <25th percentile was classed as low complexity, 25th–75th as moderate and >75th percentile as highly complex. Of the 971 434 patients identified over a range of surgical specialties, 4648 underwent thoracic surgery. Analysis of the thoracic cohort showed a significant association between higher mFI and increased morbidity for moderate- and high-complexity operations (P < 0.0001, odds ratio (OR) 1.84 and 1.57, respectively). This association was also demonstrated for mortality (P < 0.0001, OR 1.53 and 1.25); however, no association was identified for low-level complexity operations. Interestingly, within the higher risk surgical specialties (e.g. thoracic surgery), mortality ORs were lower than those of ‘lower risk’ surgical specialties (e.g. general surgery). The authors concluded that frailty increases postoperative morbidity and mortality over a range of surgical specialties, including thoracic surgery.

Tsiouris et al. [3] performed a retrospective analysis in patients undergoing lobectomy to determine whether an mFI could predict postoperative complications and mortality. A search of the NSQIP database between 2005 and 2010 yielded 1940 patients. Univariate analysis equated an mFI of 0 to a mortality rate of 1%, compared with 5.6% for an mFI of >0.27 (P < 0.001). Morbidity increased uniformly with mFI. Multivariate analysis found an mFI of >0.27 (P = 0.002) and wound contamination (P = 0.045) to be independent predictors of mortality. Regression analysis demonstrated that an mFI of >0.27 (P = 0.027), wound contamination (P = 0.028), ASA grade 4 (P = 0.009) and dependent functional status (P = 0.03) were the main predictors of major complications. Ultimately, the authors established that an mFI has the potential to act as a preoperative predictor for morbidity and mortality in this group.

Tsiouris et al. [4] conducted a further retrospective study using the NSQIP database to determine whether a functional status alone is an independent predictor of outcomes following thoracic surgery. Patients were classified based on their ability to perform ADLs in the 30-day period prior to surgery. Groups were classified as: independent (capable of all ADLs), partially dependent (some assistance with ADLs) and totally dependent (total assistance with ADLs). Partially dependent and totally dependent groups were considered as one ‘non-independent group’. A total of 6373 patients were identified; the vast majority were classified as independent (5561 vs 812). Prolonged ventilation (OR 9.3, P < 0.001), re-intubation (OR 3.1, P < 0.001) and mortality (OR 7.7, P < 0.001) were increased in the non-independent group. They concluded that pre-existing functional dependency resulted in increased postoperative complications and higher mortality rates.

Wiegel et al. [5] presented an abstract at the American Association for Thoracic Surgery Conference examining geriatric frailty assessment tools in the prediction of postoperative outcomes in patients over 70 undergoing thoracic surgery for neoplasms. The Geriatric Depression Screen, Mini Mental State Examination, Fatigue Inventory, Eastern Co-Operative Oncology Group Performance Scale and Instrumental Activities of Daily Living were used as a means of determining preoperative frailty. The scores obtained were combined with data including baseline demographics, comorbidities, renal and cardiopulmonary cardiac function and BMI. The assessments were repeated following surgery and patients followed for a period of 30 days. Seventy-nine patients undergoing oesophageal or pulmonary resection were identified. Univariate logistic regression demonstrated no individual frailty measure predictive of postoperative outcomes and Cox proportional hazard analysis showed no association with postoperative hospital stay. The authors concluded that no single measure of frailty could reliably predict postoperative outcomes, however a combination of measures may be beneficial in predicting postoperative morbidity and mortality.

Whilst many frailty indicators are included in common surgical and anaesthetic risk stratification tools, there is currently limited evidence to truly access the value to specific frailty scores for preoperative risk stratification in thoracic surgery. However, the conclusions drawn from the articles described are supported by evidence from other surgical specialties, for example the paper by Velanovich et al. [2] and, recently the review by Bagnall et al. [6] which established the value of frailty as an independent predictor of adverse outcomes following cardiac surgery. This correlation across specialties supports the need for further assessment and validation of risk assessment models incorporating frailty parameters in thoracic surgery.

**CLINICAL BOTTOM LINE**

Currently there is a paucity of evidence to support or refute the use of frailty scoring for risk stratification in thoracic surgery. However, the data available does suggest correlation and with further development may prove a valuable clinical tool in the future.

**Conflict of interest:** none declared.

**REFERENCES**


