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REVIEW

The Impact of Frailty on Outcomes of Elderly Patients After Major Vascular Surgery: A Systematic Review and Meta-analysis

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WHAT THIS PAPER ADDS

This meta-analysis evaluated the quality of evidence of all frailty tools in major vascular surgery and determined the effect of frailty on outcomes after vascular surgery. Major findings were that frailty was associated with fourfold increased risk of 30 day mortality and twofold increased risk of long-term mortality after major vascular surgery. Frailty status, evaluated by function status and central muscle mass, may predict both short and long-term mortality after major vascular surgery and should be considered as a part of the pre-operative risk score for vascular surgery.

Objective: To evaluate the quality of published evidence of all frailty tools in major vascular surgery and to determine the effect of frailty on short and long-term outcomes after vascular procedures.

Methods: MEDLINE, Embase, Cochrane Database and Scopus (updated on May 12, 2018) were searched for studies evaluating the effect of frailty in vascular surgery and data were extracted from the included studies. A modified Newcastle-Ottawa scale was used to assess the quality of the included studies. The impact of frailty on outcomes was expressed as odds ratios (OR) or hazard ratios (HR) using a random effects model.

Results: A total of 22 cohort studies and one RCT were included. Overall frailty was found to be associated with a significantly increased risk of 30 day mortality in patients who underwent vascular surgery (OR 3.83, 95% CI 3.08—4.76), with similar effects in both patients who underwent abdominal aortic aneurysm (AAA) repair (OR 5.15, 95% CI 3.91—6.77) and lower extremity revascularisation (OR 3.29, 95% CI 2.53—4.28). Functional status remained the only tool with high quality of evidence predicting 30 day mortality after vascular surgery (OR 4.49, 95% CI 3.81—5.30). As for long-term outcomes, frailty was associated with a significantly increased risk of long-term all cause mortality in the overall studied population (HR 2.22, 95% CI 1.81—2.73), as well as in patients with AAA repair (HR 2.10, 95% CI 1.59—2.79) and lower extremity revascularisation (HR 2.46, 95% CI 1.73—3.49). Central muscle mass was found to be the only tool with moderate quality of evidence predicting long-term survival after major vascular surgery (HR 2.48, 95% CI 1.76—3.49). Other single domain tools were generally scored as low quality, and the modified Frailty Index was the only multi-domain tool with moderate quality while others were scored as low or very low.

Conclusion: Frailty, assessed by functional status, can predict short-term mortality in elderly patients after vascular surgery; while central muscle mass may help determine long-term survival in abdominal aortic repair. As frailty is associated with both worse short and long-term outcomes, frailty assessment may be considered in patients scheduled for vascular surgery.

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INTRODUCTION

In the next several decades, the proportion of elderly patients will increase sharply as longevity generally increases for the population.[1] For the first half of the 21st century, the proportion of the population aged over 60 years is estimated to climb from 20% in 2000 to 33% in 2050.[2] The increasing number of elderly patients will bring great challenges to the quality of vascular services.[3] Although the development of endovascular intervention provided an approach with less trauma and stress, some elderly patients still suffered from major post-operative complications, poor quality of life, and even death. Therefore, pre-operative assessment of whether elderly patients can benefit from the surgery is essential for better clinical outcomes.

Frailty is one of the crucial components of geriatric pre-operative assessment, which is defined as a biological syndrome of decreased reserve and resistance to stressors resulting from cumulative declines across multiple physiological systems, and further causes vulnerability to adverse outcomes.[4,5] Recent evidence has suggested that the very early stages of vascular diseases, endothelial dysfunction, is already associated with frailty, thus evaluation of frailty is necessary in vascular diseases.[6] Currently, many validated frailty tools are proven to aid post-operative risk categorisation and predict long-term prognosis, as a supplement to traditional surgical risk measurement.[7–12] However, no consensus has been built to specify how to best assess pre-operative frailty.[7,8] For vascular surgery, published studies provide differing opinions on the effect of frailty on clinical outcomes after vascular procedures.[13–15]

Frailty is an emerging area of study in pre-operative risk evaluation; however, its integration in vascular surgery clinical practice is hindered by a lack of consensus on its real effect and how best to measure it. The aims of the present systematic review and meta-analysis were to evaluate the quality of evidence of all published frailty tools in major vascular surgery and to measure the effect of frailty status on the short and long-term outcomes of vascular surgery.

METHODS

Review protocol

Prior to conducting the review, the protocol was registered and outlined in the International prospective register of systematic reviews (PROSPERO), registration number CRD42017076112. This systematic review and meta-analysis was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statements checklist,[16] and reported the included observational clinical studies according to the Meta-analysis of Observational Studies in Epidemiology (MOOSE) standard[17] (Table S1).

Data sources and searches

MEDLINE was searched from 1946 to September 2017, Embase from 1974 to September 2017, Cochrane Database, and Scopus, for original articles that investigated any frailty measurement in patients who underwent vascular surgery. The following MeSH terms or keywords were used: “frail elderly” OR “geriatric assessment” OR “frailty” OR “sarcopenia”; “vascular surgical procedures” OR “endovascular procedures.” Detailed search strategies can be found in Appendix 1 (supplementary material). The reference lists for potential articles meeting the inclusion criteria were manually examined. The electronic literature search was updated on May 12, 2018.

Study selection

Two authors (JW and YZ) independently carried out the study selection based on standard inclusion and exclusion criteria. Disagreements were resolved by discussion with a third author (YY). The inclusion criteria consisted of the following: 1) original articles evaluating the effect of frailty on outcomes after vascular surgery; 2) the measurement of frailty can include both single domain items including cognitive, central muscle mass, function dependency and nutrition, etc. and multi-domain tools developed for frailty assessment; 3) the mean age of study participants was 60 years or older; 4) the post-operative outcomes were reported according to pre-operative frailty status. Articles were excluded if the patients with vascular disease had not undergone surgery, or if the frailty status was not measured before surgery.

Data extraction

Two authors (JW and YZ) used a standardised form to collect data from the included articles. Discrepancies were handled by input from a third reviewer (JZ). If one study included data for more than one type of patient, these were then treated as separate studies. The primary outcome of interest was mortality, including 30 day mortality and long-term overall survival. The secondary outcome of interest was mainly 30 day morbidity. The count of events and total number of patients in the frail and non-frail groups were extracted for dichotomous short-term outcomes, and hazard ratio (HR) and standard errors (SE) for time to event data were extracted for long-term survival.

Quality assessment

Two investigators (JW and YZ) independently evaluated the included cohort studies using a scale modified from the Newcastle-Ottawa Scale specified for cohort studies evaluating frailty status[18,19] (Table S2). The scale included the following domains: representativeness of the study population, use of frailty measures that were validated in the general population of older adults, frailty status determination, loss to follow up or amount of missing outcome data (death and functional status, separately), missing data on frailty measures, and validation of the risk prediction performance. In addition, the overall quality of evidence for each frailty tool, outcome pair was assessed based on the representativeness of study populations, risk of bias, consistency in the results across studies, and strength of associations, which were modified from the

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