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# Prevalence of Abdominal Aortic Aneurysm (AAA) in a Population Undergoing Computed Tomography Colonography in Canterbury, New Zealand

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**WHAT THIS PAPER ADDS**

In a previously unscreened population, computed tomography colonography was used as a surrogate for an abdominal ultrasound, at no extra cost or increased risk of radiation, to determine the prevalence of abdominal aortic aneurysm (AAA). The prevalence of AAA in men was similar to that in published randomised AAA screening trials. Knowledge of contemporary AAA prevalence in women and octogenarians—two groups that have not been included in screening programmes—is extended. The data presented highlight the high prevalence of AAA, particularly in the elderly, and the challenges that health services might encounter from the AAA burden.

**Objective/Background:** There is compelling level 1 evidence in support of screening men for abdominal aortic aneurysm (AAA) to reduce AAA mortality. However, New Zealand (NZ) lacks data on AAA prevalence, and national screening has not been implemented. The aim of this study was to determine the prevalence of AAA in a population undergoing a computed tomography colonography (CTC) for gastrointestinal symptoms.
**Methods:** This was an observational study; all consecutive CTCs performed in three regions of the South Island of NZ over a 4 year period were reviewed. Data on abdominal and thoracic aorta diameters ≥30 mm, and iliac and femoral aneurysms ≥20 mm were recorded. Previous aortic surgical grafts or endovascular stents were also documented. Demographics, survival, and AAA related outcomes were collected and used for analysis.
**Results:** Included were 4,893 scans on 4,644 patients (1,933 men [41.6%], 2,711 women [58.4%]) with a median age of 69.3 years (range 17.0–97.0 years). There were 309 scans on 289 patients (75.4% men) who had either an aneurysm or a previous aortic graft with a median age of 79.6 years (range 57.0–96.0 years). Of these, 223 had a native AAA ≥30 mm. The prevalence of AAA rose with age from 1.3% in men aged 55–64 years, to 9.1% in 65–74 year olds, 16.8% in 75–84 year olds, and 22.0% in ≥85 year olds. The corresponding figures in women were 0.4%, 2%, 3.9%, and 6.2%, respectively.
**Conclusion:** In this observational study, the prevalence of AAA was high and warrants further evaluation. The results acquired help to define a population that may benefit from a national AAA screening programme.

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## INTRODUCTION

Abdominal aortic aneurysm (AAA) screening using an abdominal ultrasound (US) has been shown to reduce AAA mortality in asymptomatic men over the age of 65 years.[1] The uptake of national screening programmes has been slow for several reasons, including changing epidemiology,[2,3] lack of funding or awareness, and varying AAA prevalence among different populations and ethnicities. In New Zealand (NZ), the true prevalence of AAA is unknown and detection still relies on incidental findings from radiological modalities and referrals from other physicians. The global AAA burden has changed between 1990 and 2010. However, the incidence of AAA has been highest in Australasia, despite a decrease in trends in NZ.[4]

In Canterbury, NZ, a pathway to triage patients with gastrointestinal (GI) symptoms was introduced in 2008. Depending on clinical symptoms, physical examination findings, family history, and laboratory results, a high score directs referrals to an endoscopic colonoscopy, while a low score directs referrals to a computed tomography

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colonography (CTC) first approach.[5] Owing to constraints on the public health system in providing colonoscopy for symptomatic patients, the use of CTC for the detection of colorectal diseases and colonic surveillance has gained popularity in NZ as an alternative to optical colonoscopy. It has also been used when colonoscopy could not be completed and in the surveillance of colonic diseases. A CTC (also referred to as "virtual colonoscopy") is a non-invasive, low dose CT that assesses the entire colon by inflating air via the rectum to allow distension of the colon and visualisation of colonic pathology. Other potential advantages of CTC include visualisation of extra-colonic pathologies such as AAA at no additional cost or radiation risk. CT also permits assessment of the entire aorta (usually the descending thoracic aorta to femoral bifurcation) and precise measurement of the aortic wall without hindrance from bowel gas or obesity.

Previous model studies revealed that dual screening for colorectal cancer (CRC) and AAA using CTC was more cost effective in a hypothetical population when compared with optical colonoscopy and an abdominal aortic US.[6,7] While randomised trials of AAA screening used US to measure the abdominal aorta, in the absence of a national US screening programme, the aim of this study was to use CTC as a surrogate for US to document the prevalence of AAA in a population undergoing CTC for GI symptoms.

## METHODS

This was a retrospective observational study. From 1 January 2009 to 1 April 2013 all consecutive CTCs performed in the Canterbury, West Coast, and Timaru regions of South Island, NZ, were retrieved from the picture archiving computer system (PACS) database. The retrospective nature of the study precluded individual patient consent. The study was approved by the national Health and Disability Ethics Committee.

The CTC examination was performed at seven different centres with similar protocols. A rectal or stomal tube was inserted for air inflation; a helical CT with 2.5 mm slices was performed in the prone and supine positions, with a large field of view. Intravenous contrast was used if the diagnosis of malignancy was known, or as indicated clinically. The presence of a distended distal bowel and rectal or stomal tube was confirmed to ensure that the scan was a CTC.

### *Measurements*

The entire available aorta from the series—usually from the descending aorta into the femoral bifurcation—was meticulously assessed. Any dilatation or abnormal change in aortic calibre triggered aortic measurements of the dilated segments. Measurements were performed with a digital magnified view—at eye level to avoid any parallax—using outer wall to outer wall lengths using fine electronic callipers, also ensuring that the line of measurement passed through the centre of the aneurysm.[8] Maximum short axis diameters were recorded to 0.1 mm. The presence of a thoracic and abdominal aorta $\geq$30 mm, iliac and femoral arteries $\geq$20 mm, and a visceral artery $\geq$1.5 mm were recorded. The presence of previous aortic prosthetic grafts or endovascular stent grafts was also documented. All measurements were carried out by the same investigator (M.K.).

Demographical data for all patients, including dates of death, deprivation index, and ethnicity, were obtained from the Ministry of Health's database. Deprivation index was defined as the measure of the socioeconomic status of geographical areas based on 2013 NZ census data, where 1 is least deprived and 10 is most deprived.[9] Clinical risk factors, aneurysm location, colorectal cancer (CRC) diagnosis, and causes of death were collected from patients with aneurysms or previous aortic surgery. CTC radiologist reports were viewed to determine whether the presence of aneurysms was commented on and whether patients were in a AAA surveillance programme. The aneurysm with the largest diameter was defined as the primary aneurysm; other aneurysms detected were referred to as secondary. Estimated predicted life expectancy figures were obtained from the NZ life tables 2010—12 (www.stats.govt.nz) for a fictive population matched to age and sex.[10]

Preliminary analysis indicated that the continuous explanatory variables (age and deprivation) were related to the presence of AAA (binary) on a linear rather than a logarithmic scale; therefore, linear regression models were used to calculate unadjusted and adjusted rate differences.[11] Rate ratios were also calculated for categorical variables using Poisson regression with robust standard errors due to non-convergence of log binomial models.[12] Kaplan—Meier methodology was used for survival analysis, and the log rank test was used for univariate group comparison. The Cox proportional model was used to calculate adjusted and unadjusted hazard ratios (HRs) for variables influencing survival. Survival data were censored on 1 October 2014. Statistical significance and 95% confidence intervals (CIs) were calculated with an alpha of 0.05. Statistical analyses were performed using SPSS 22 for Mac (IBM, Armonk, NY, USA).

## RESULTS

During the study period, 4,915 CTC scans were performed on 4,665 patients. Of these scans, 22 were coded on the PACS database as CTC but when the scans were reviewed, the CT was not a CTC or the raw axial images were not stored and were therefore excluded from any further analysis. Hence, 4,893 scans on 4,644 patients (male: female ratio = 1.0: 1.4) and a median age of 69.3 years (range 17.0—97.0 years) were reviewed. Excluded from further analysis were 925 patients aged $<$55 years old who had no AAA detected. The median age of the remaining 3,719 individuals was 72.9 years (range 55.0—97.4 years). The number of CTC scans performed in the years 2009—12 was 1,039, 1,174, 1,169, and 1,178 scans, respectively.

There were 309 scans on 289 patients who had either an aneurysm in any location or a previous abdominal aortic graft repair. The location of aneurysms and abnormal aortas