Use of gastrostomy tubes in older Western Australians: a population-based study of frequency, indications and outcomes

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ABSTRACT

Objective: To determine the number of older Western Australians who had a gastrostomy tube (GT) placement from 1994 to 2004, to describe their characteristics, and to examine outcomes after GT placement, including rehospitalisation for complications and survival.

Design and data sources: Secondary analysis of hospital (inpatient) data and linked mortality data from the WA Data Linkage System.

Main outcome measures: Patient characteristics (age, sex and morbidity profile); numbers of GT closures, replacements and complications within 1 year of GT placement; age- and sex-specific survival outcomes calculated at 7, 30, 60 and 180 days, and 1 and 3 years; and mortality hazard ratios calculated for six conditions of interest, identified using all available diagnosis information on the inpatient record.

Results: In Western Australia, 2023 people aged 65 years or older underwent a GT placement for the first time during the period 1994–2004, half of whom had a known history of cerebrovascular disease (50.3%). Rehospitalisation within 1 year for a GT replacement procedure, mechanical complications and incident pneumonitis occurred in 13%, 4% and 9% of patients, respectively. More than half of the patients who underwent a GT placement died within 1 year. Survival outcomes were poorest for patients with motor neurone disease and metastatic cancer.

Conclusion: To better understand this complex area of health care, questions regarding decision making — by patients, families, physicians, hospitals and other caring organisations — about GT placement and maintenance need to be addressed.

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Enteral tube feeding is a form of artificial nutrition that provides nutrients, hydration and medications on a long-term basis (> 1 month) directly into the gastrointestinal tract rather than via the mouth. It is predominantly used in older people with debilitating conditions (advanced head or neck tumours,[1] motor neurone disease[2] and stroke complicated by dysphagia[3]) who have a functioning and accessible gastrointestinal tract but an impaired swallowing mechanism. The most widely used method for enteral feeding involves placing a feeding tube directly into the stomach via percutaneous endoscopic gastrostomy (PEG),[4] a minimally invasive, non-surgical procedure introduced in the 1980s.[5] Despite its simplicity, enteral feeding remains controversial owing to uncertain benefits and considerable risks, and because it often involves patients without capacity and with unknown preferences within a complex ethical and legal framework.[6]

This study had three aims: to determine the number of older Western Australians hospitalised for gastrostomy tube (GT) placement (PEG and non-PEG [non-endoscopically placed gastrostomy]) from 1994 to 2004 using linked administrative health data, to describe their characteristics, and to examine outcomes after GT placement, including rehospitalisation for complications, and survival. To our knowledge, this is the first Australian study of its kind.

METHODS

Population selection

We obtained de-identified hospital admissions data linked to mortality data from the WA Data Linkage System. The study population included all patients 65 years or older who were admitted to a public or private hospital in Western Australia for an initial placement of a feeding tube, as defined by procedural codes of the *International classification of diseases, injuries and causes of death*, ninth revision, clinical modification (ICD-9-CM) (codes 43.1, 43.11, 43.19) and the *International statistical classification of diseases and related health problems*, 10th revision, Australian modification (ICD-10-AM) (codes 30481-00, 30483-00, 30375-00).[7,8] A 5-year inpatient look-back period was used to confirm that patients identified by ICD-10-AM codes were undergoing these procedures for the first time. The data sources did not include additional clinical information, such as who was involved in the decision to place a GT, the severity of dementia, or the location to which the patient was discharged (home or residential aged care).

Indications for GT placement were determined using the primary diagnosis of the index (first) GT record, categorised according to ICD chapters. Additionally, six conditions of interest — cerebrovascular disease, dementia, cancer without metastases, cancer with metastases, motor neurone disease and Parkinson's disease — were identified from all diagnosis fields for all hospital admissions in the 12-month period up to and including the index GT admission. The Charlson Comorbidity[9] score was calculated similarly. Each member of the cohort was followed up for a maximum of 3 years from their index GT placement inpatient record.

The study received approval from the Human Research Ethics Committee of Curtin University of Technology.

Statistical analysis

Estimates of cumulative mortality by age (65–74, 75–84, 85 + years) and sex were calculated at 7 days, 30 days, 60 days, 180 days, 1 year and 3 years after GT placement, using the Kaplan–Meier method.[10] Hazard ratios for the six conditions of interest were calculated using Cox proportional hazards regression, adjusting for age, sex, Charlson Comorbidity score, and year of GT placement. As we found that the Charlson Comorbidity score had little association with the log hazard ratio across scores 1 to 3, but was associated with a linear increase in the log hazard ratio for scores 4 or higher, we modelled the effect of the Charlson Comorbidity score as two linear splines. Similarly, age was fitted as a continuous variable as we found it was linearly associated with the log hazard ratio. The proportional hazards assumption was assessed by examining the Schoenfeld residuals for each

1 Characteristics of older patients who underwent gastrostomy tube placement, Western Australia, 1994–2004

	Men (n = 1103)	Women (n = 920)
Age (years)		
65–69	187 (17.0%)	128 (13.9%)
70–74	284 (25.7%)	166 (18.0%)
75–79	258 (23.4%)	191 (20.8%)
80–84	203 (18.4%)	215 (23.4%)
85 +	171 (15.5%)	220 (23.9%)
Year		
1994	51 (4.6%)	32 (3.5%)
1995	70 (6.3%)	35 (3.8%)
1996	77 (7.0%)	73 (7.9%)
1997	78 (7.1%)	81 (8.8%)
1998	109 (9.9%)	112 (12.2%)
1999	135 (12.2%)	117 (12.7%)
2000	152 (13.8%)	106 (11.5%)
2001	101 (9.2%)	91 (9.9%)
2002	100 (9.1%)	73 (7.9%)
2003	113 (10.2%)	94 (10.2%)
2004	117 (10.6%)	106 (11.5%)
Charlson Comorbidity score		
0	190 (17.2%)	150 (16.3%)
1	181 (16.4%)	187 (20.3%)
2	155 (14.1%)	117 (12.7%)
3	220 (19.9%)	222 (24.1%)
4	145 (13.1%)	124 (13.5%)
5 +	212 (19.2%)	120 (13.0%)

covariate. Data were analysed using Stata release 10 (StataCorp, College Station, Tex, USA).

RESULTS

In WA, 2023 people aged 65 years or older underwent a GT placement for the first time between 1994 and 2004 (Box 1). Men tended to have their first GT placement at a younger age (median, 76.5 years; interquartile range [IQR], 71.5–82.3 years) than women (median, 79.3 years; IQR, 73.2–84.8 years). The number of initial GT placement procedures performed each year varied. In 1994, 83 were performed; in 1999, the annual number of procedures had increased to 252; and the number then declined by about a third to 173 in 2002.

Patients' medical conditions

Based on the primary diagnosis on the index GT record, the category of diseases of the circulatory system was the most common indication for GT placement (n = 622, 30.7%), which predominantly involved cerebrovascular disease (n = 570, 28.2%). This was followed by symptoms, signs and ill-defined conditions (n = 337, 16.7%) that predominantly involved dysphagia and pneumonitis, then neoplasms (with and without metastases; n = 269, 13.3%), and then diseases of the nervous system (n = 166, 8.2%). The remaining 629 people (31.1%) had other indicator conditions (ie, primary diagnoses).

On review of hospital admissions in the 12 months before the index admission, more than half of GT recipients (50.3%) had a known history of cerebrovascular disease. Other medical conditions identified are listed in Box 2. In people with dementia at the time of GT placement (11.2%), almost half also had cerebrovascular disease (47.6%) and 14.1% had Parkinson's disease. Malnutrition at the time of the index admission was rare (1.7%).

Gastrostomy closure, and GT replacements and complications

Gastrostomy closure within a year of GT placement was rare (n = 11, 0.5%). During this period, 259 patients were hospitalised for GT replacement (12.8%), 74 for mechanical complication of a gastrointestinal prosthetic device (3.7%) and 177 for pneumonitis due to food and vomit (8.7%).

Mortality outcomes after GT placement

Mortality after GT placement was substantial. At 30 days, 16.6% of recipients had died (95% CI, 15.1%–18.3%), and the proportion of patients who had died increased to 26.3% by 60 days (95% CI, 24.4%–28.3%), 54.2% by 1 year (95% CI, 52.1%–56.4%), and 74.1% (95% CI, 72.1%–75.9%) by 3 years. Median survival was 53.3 weeks for women (95% CI, 45.1–63.4) and 34 weeks for men (95% CI, 29.1–40.3). The survival advantage of women compared with men was evident across all age groups (Box 3).

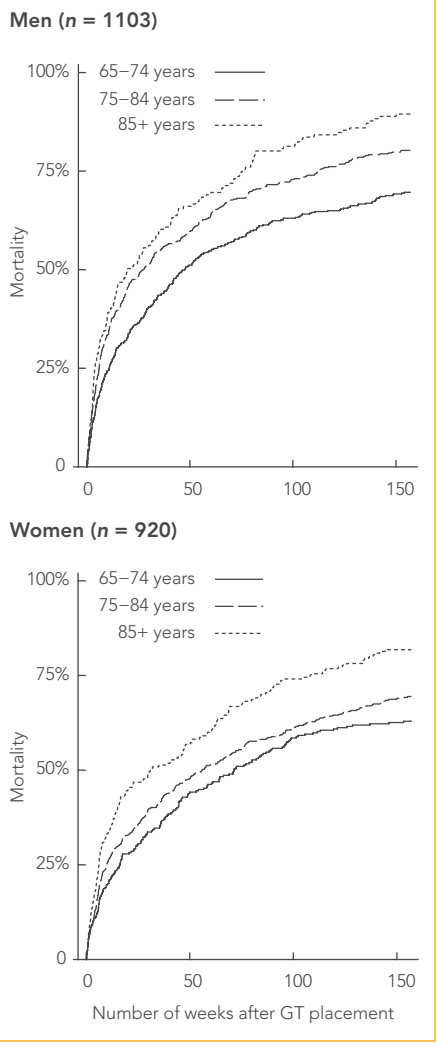
The risk of mortality varied among the six conditions of interest (Box 4), after adjusting for age, sex, other comorbidities (using the Charlson Comorbidity score) and year of GT placement. The risk of mortality was 81% higher in patients with motor neurone disease than those with other conditions. In cancer patients, the mortality risk was increased by 37% among those without metastases, and by 53% among those with metastases. The risk in patients with cerebrovascular disease was 13% lower than in other patients. In patients with dementia, the risk was 15% higher than in other patients, but the confidence interval around this estimate is wide, hence chance alone might account for this result. The risk in patients with Parkinson's disease was not different to the risk in other patients. Overall, the mortality risk in women was 19% lower than in men, and each year of age was associated with a 4% increase in mortality risk. Even though the number of procedures performed during each year of the study varied considerably (Box 1), calendar year was not associated to any large degree with mortality risk. For Charlson Comorbidity scores below 4, there was no association between score and mortality risk, but for scores of 4 or more, each unit increase in the score was associated with a 4% increase in mortality risk.

2 Medical conditions of older patients who underwent gastrostomy tube placement, Western Australia, 1994–2004*

Medical condition	
Cerebrovascular disease	1017 (50.3%)
Paraplegia or hemiplegia	720 (35.6%)
Any malignancy, including leukaemia or lymphoma	345 (17.1%)
Dementia	227 (11.2%)
Diabetes without complications	214 (10.6%)
Chronic pulmonary disease	205 (10.1%)
Congestive cardiac failure	204 (10.1%)
Peptic ulcer disease	150 (7.4%)
Motor neurone disease	147 (7.3%)
Metastatic solid tumour	143 (7.1%)
Peripheral vascular disease	107 (5.3%)
Parkinson's disease	105 (5.2%)
Myocardial infarction	81 (4.0%)
Renal disease	78 (3.9%)
Diabetes with complications	62 (3.1%)
Connective tissue and rheumatological disease	31 (1.5%)
Mild liver disease	16 (0.8%)
Multiple sclerosis	10 (0.5%)
Moderate or severe liver disease	< 10 (< 0.5%)
HIV/AIDS	< 10 (< 0.5%)
Huntington's disease	< 10 (< 0.5%)

* Data represent 2023 patients; multiple conditions are possible; and patient numbers fewer than 10 have been suppressed to preserve confidentiality. ◆

3 Cumulative mortality of older men and women by age, after gastrostomy tube (GT) placement, Western Australia, 1994–2004



DISCUSSION

Despite substantial variation in the numbers of index GT placement procedures performed each year in WA during the period 1994–2004, there was no evidence of a secular change in mortality. The variation was not an artefact of changes to the ICD coding of GTs, or a result of any initiatives introduced by the WA Department of Health. It is possible that the dramatic increase in GT placement procedures that occurred during the period 1997–1999 coincided with the introduction of the *Aged Care Act 1997* (Cwlth), which was associated with an exhaustive accreditation process and little direction about the best practice for a palliative approach in residential aged care facilities. The decline in GT placements thereafter may be associated with publications such as the third edition of the *Medical care of older persons in residential aged care facilities*[11] (published in 1999), which promoted explicit discussion and planning of end-of-life decisions with residents.

Recipients of GTs were typically older than 75 years, characterised by a diagnosis of cerebrovascular disease, neurodegenerative disease (such as motor neurone disease and Parkinson's disease) or cancer, with multiple additional chronic comorbidities — commonly including diabetes, chronic pulmonary disease, and paraplegia or hemiplegia. Few patients in our cohort were recorded as malnourished at the time of GT placement, suggesting that enteral feeding started before malnutrition was evident.

The prevalence of medical conditions differed markedly depending on whether estimates were derived from the primary diagnosis reported on the inpatient record for the index GT placement only, or also used additional data from co-diagnosis fields and a 12-month retrospective period. We argue that, using Australian inpatient data, the latter represents a superior approach, which results in greater disease-specific case ascertainment (eg, 28% v 50% for cerebrovascular disease). Our prevalence estimates for cerebrovascular disease and neurodegenerative disorders were considerably lower than those reported from a United States community-based study (28% v 40% and 8% v 35%, respectively),[12] perhaps reflecting the different settings. Alternatively, these data may represent real differences in GT usage between WA and the US.

Mortality during the 12 months after GT placement was substantial. Our results are broadly comparable with pooled international mortality estimates, except for a noticeably lower 1-year mortality estimate in our study (54% v 62%).[13] The reason for this difference is unclear. It might be explained by differences in the clinical features of the populations studied — for example, higher prevalence of neurodegenerative disorders overseas, and differences in disease duration or age of disease onset. It may also imply that Western Australian clinicians are more selective in the use of GTs.

The explanation for international differences is likely to be multifactorial, particularly as feeding tube practice is influenced by a range of complex legal, professional and ethical factors that are external to the patient's clinical features. These include caregiver convenience, differences in referral patterns, financial incentives, organisational factors (size, location, staffing), ethnicity and other demographic characteristics.[12,14-16] Uncertainty among physicians about the indications for GT placement[17] and regulatory concerns, particularly about being sanctioned for "starvation" or "mistreatment", may also promote international variation, including the use of feeding tubes in a manner that is inconsistent with medical advice.[18]

Few studies have examined mortality beyond the first 12 months,[19] and we found that one in four GT recipients lived for up to 3 years. We found no evidence to support poorer survival after GT placement in older people with dementia, which is consistent with previously published data.[16] Older people with cerebrovascular disease had significantly better survival in the 3 years after GT placement compared with all other GT recipients. In contrast, the survival of older people with metastatic cancer or motor neurone disease was substantially poorer. These findings show that enteral feeding may serve different purposes depending on the clinical features of the patient.[4]

GT-related complications were not uncommon. Rehospitalisation within 1 year for a GT replacement procedure, mechanical

4 Mortality risk for older patients after gastrostomy tube placement associated with six conditions of interest, Western Australia, 1994–2004 (*n* = 2023)

	Hazard ratio (95% CI)
Medical condition	
Cerebrovascular disease	0.87 (0.75–1.02)
Dementia	1.15 (0.98–1.36)
Cancer without metastases	1.37 (1.13–1.65)
Cancer with metastases	1.53 (1.07–2.20)
Motor neurone disease	1.81 (1.49–2.19)
Parkinson's disease	0.95 (0.76–1.20)
Sex (female)	0.81 (0.73–0.90)
Age (years)	1.04 (1.03–1.05)
Calendar year	0.99 (0.98–1.01)
Charlson Comorbidity score 1–3	0.99 (0.93–1.06)
Charlson Comorbidity score 4 +	1.04 (1.00–1.08)

complications and incident pneumonitis occurred in 13%, 4% and 9% of patients, respectively. These are probably underestimates, as we only counted those patients who had complications that were severe enough to require hospitalisation. Other complications that may have been managed in an outpatient or community setting include peristomal infection; leakage; tube removal, displacement or migration; bleeding; gastric mucosal overgrowth or ulceration; metabolic and biochemical complications (eg, refeeding syndrome); gastrointestinal side effects; and microbial contamination and infection of feed.[20,21]

It is uncertain whether the use of GTs is accompanied by demonstrable health benefits, patient comfort and a satisfactory quality of life, or whether their use inadvertently interferes with the dying process and prolongs suffering.[12] This issue is complicated by various medicolegal and ethical considerations concerning the use of feeding tubes. The Australian Medical Association has described artificial nutrition and hydration (ANH) as a life-sustaining treatment, and stated that the cessation or non-initiation of such measures is in accordance with good medical practice and does not constitute euthanasia or physician-assisted suicide.[22] Also, competent adults have the legal right to accept or refuse any medical treatment, including ANH, and in WA and most other Australian states and territories, competent adults are able to complete advance health directives ("living wills"), including directives to withdraw or withhold life-sustaining measures such as ANH when they are no longer competent.[23]

In conclusion, additional research is required for a better understanding of this complex area of medical care. Specific questions that need to be addressed include: How do patients, families, physicians, hospitals and other caring organisations operate within the regulatory framework to decide whether to insert a GT? How appropriate is continued GT maintenance? Is continued GT maintenance consistent with the patient's medical condition, prognosis and preferences?

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COMPETING INTERESTS

None identified.

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