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RESEARCH ARTICLE

# Effectiveness of Multi-Disciplinary Perioperative Geriatric Surgical Service Consultation for Vascular In-Patient Population

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## Abstract

**Introduction:** Geriatric surgical patients carry increased peri-operative risks, particularly in vascular patients. We aim to evaluate patient outcomes before and after introduction of a Geriatric Surgical Service (GSS) for vascular inpatients.

**Methods:** A matched case-control study of 211 vascular acute admissions at a tertiary teaching hospital. 75 patients who were co-managed with GSS between August 2015 and May 2016 were matched with 135 patients between 2014 and 2015 in a 1:2 ratio according to age, gender, diagnosis and operative procedure.

**Results:** Baseline characteristics between the two study groups were similar, with mean age at 76 years-old. There was no difference in their comorbidities (as per Charlson Index) with age score (6.59 within GSS group vs 6.54 within control group). 78% of the study population were admitted for lower limb peripheral vascular disease, with 33% undergoing revascularisation, 21% undergoing major amputations and 39% undergoing minor amputations. We found a significantly shorter length of stay within the GSS group compared to the control group (15 days vs 20 days, p=0.003). There was also a trend of decreased post-operative pneumonia (11% vs 14%, p=0.325), urinary tract infection (8% vs 12%, p=0.286) and 30-day mortality (1% vs 4%, p=0.231) within the GSS group. There was a slight increase in the detection of post-operative delirium (13% vs 10%, p=0.315).

**Conclusion:** Elderly vascular inpatients had significantly shorter length of stay through a multi-disciplinary model of care between the Vascular surgical team and GSS. There was also a trend of decreased nosocomial infections and 30-day mortality.

**Keywords:** Geriatric Care; Geriatric Surgical Service; Multi-Disciplinary Team; Perioperative Care; Vascular Surgery

## Introduction

With advancing healthcare and decreasing birth rates, the global population is currently experiencing ageing at an unprecedented pace. By 2050, one in five of the world population will be over 60 years of age [1]. In Singapore, the proportion of those over 65 years of age expected to reach one in four of the general population by 2030 [2].

The geriatric surgical patient presents a unique set of complexities due to an interplay of decreased functional and nutritional status, multiple comorbidities, poly-pharmacy, psychogeriatric and psychosocial issues [3-5]. Compared to the average surgical patient, the vascular patient also has a higher mean age with a higher prevalence of multiple comorbidities, placing him at a higher perioperative risk [6]. Geriatric syndromes such as delirium, functional decline, falls, and pressure ulcers commonly occur in older adults undergoing surgery, and having a multidisciplinary geriatric consultation is one attempt to address these challenges, which may fall outside of a general surgeon's area of expertise [7]. A geriatric consultation service has shown promising improvement in outcomes for elderly colorectal surgery and trauma patients [8,9]. A randomized clinical trial of comprehensive geriatric assessment and optimization in vascular surgery by Partridge and colleagues showed that preoperative comprehensive geriatric assessment was associated with a shorter length of hospital stay and patients undergoing assessment and optimization had a lower incidence of complications and were less likely to be discharged to a higher level of dependency [10].

## Aim

The Geriatric Surgical Service (GSS) in Tan Tock Seng Hospital, a 1,500-bed tertiary referral university hospital, was initiated in 2015. This study aimed to determine its impact on patient outcomes by comparing them before and after implementation of the GSS.

# Methods

## Study Design

This was a single centre, matched case-cohort study. Prospective data was collected from the intervention group, of which the patients were co-managed by the GSS and vascular surgery team. There were a total of 75 patients, consisting of all consecutive peri-operative vascular admissions more than 65 years of age during the period of August 2015 to May 2016 in our institution. All were emergency admissions. Each patient in the intervention group was matched in a 1:2 ratio to a retrospective cohort according to age, gender, diagnosis and operative procedure, from vascular surgical inpatient admissions between 2014 and 2015 (prior to implementation of GSS). Matching was performed to ensure that comparison of outcomes were for similar groups of patients before and after GSS intervention. Baseline patient characteristics were compared between the control and intervention groups using the Charlson Co-morbidity Index (CCI) [11]. Outcomes studied include the length of hospital stay and rates of postoperative delirium congestive cardiac failure, acute myocardial infarction (AMI), nosocomial pneumonia, nosocomial urinary tract infection (UTI), 30-day readmission and 30-day mortality. Delirium was defined as an acute disturbance of consciousness or change in cognition that developed over a short period of time, which was thought to result from the physiological consequences of the patient's medical condition.

## Geriatric Surgical Service

Our GSS consists of a Geriatric Consultant, Registrar and Advanced Practice Nurse. Patients who fit the inclusion criteria as above were referred formally to this team, and would thereafter be seen daily by both GSS and vascular surgical teams in a combined ward round followed by subsequent specialist reviews later in the day. The GSS team used the Comprehensive Geriatric Assessment (CGA) as the clinical approach for perioperative patient assessment and evaluation [12].

CGA is an established systematic approach for evaluating and optimising the medical, mental health, functional and social issues in older people to improve longer term outcome [12,13]. It involves thorough multi-domain assessments, followed by delivery of holistic plan for treatment, rehabilitation and longer-term follow-ups.

Evidence has shown that CGA reduces mortality and morbidity, increases independence and reduces the risk of institutionalisation in medical inpatients and community-dwelling older people [12,13]. A recent systematic review that examined two randomised controlled trials and three quasi-experimental studies of older patient undergoing elective surgery showed that pre-operative CGA followed by patient-specific optimisation has a positive impact on postoperative outcomes in terms of medical complications and length of stay [13].

## Charlson Co-morbidity Index (CCI)

The CCI predicts the one-year mortality for a patient based on 22 comorbid conditions. Each condition is weighted with a score of 1, 2, 3, or 6, with a higher score for higher associated risk of dying. Scores are summed to provide a total score to predict mortality. Since Charlson *et al.*'s original article in 1987, it has been cited over 21,000 times and the CCI has been validated in various disease subgroups including cancer, renal disease, stroke, intensive care, and liver disease [11,14-20]. It therefore provides a consistent, reproducible means of comparing the comorbidity burden between two patient groups.

## Statistical Analysis

SPSS (SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp) was used for the data analysis. All continuous variables were compared using independent-samples t test. All categorical variables were described as percentages and compared by either the chi-squared or Fisher's exact test. A P value $<0.05$ was considered statistically significant.

# Results

Both groups were similar in terms of age and comorbidities as measured by the Charlson Comorbidities Index (CCI) (Table 1). Most of the patients (78%) included in the study were admitted for complications of lower limb peripheral vascular disease, and 33% received revascularisation therapy, 21% had major amputation and 39% had minor amputations, and the proportion of patients who received each intervention was similar between both groups (Table 1).

In terms of patient outcomes, patients in the GSS group had a significantly shorter length of stay as compared to the control group (15.4 vs 20.8 days, p=0.003). They had similar rates of congestive cardiac failure (7%), acute myocardial infarct (7% vs 6%) and 30-day readmission rates (35% vs 34%). As compared to the control group, there was a slightly higher rate of postoperative delirium (13% vs 10%), possibly due to better detection and recognition. There was a trend towards a lower rate of nosocomial pneumonia

(11% vs 14%, p=0.325), nosocomial urinary tract infection (8% vs 12%, p=0.286) and 30-day mortality (1% vs 4%, p=0.231) when comparing the GSS group against the control group, although these did not reach statistical significance (Table 2).

| Characteristics | GSS (n=75) | Control (n=135) | p value |
|---|---|---|---|
| Mean Age (range) | 76 (65 - 93) | 74 (65 – 91) | N/A |
| **Pre-operative co-morbidities** | | | |
| Ischaemic heart disease | 19 (25%) | 28 (21%) | 0.50 |
| Chronic kidney disease | 13 (17%) | 16 (12%) | 0.18 |
| Diabetes Mellitus | 18 (24%) | 30 (22%) | 0.41 |
| Previous cerebral vascular accidents | 11 (15%) | 24 (18%) | 0.44 |
| Chronic lung disease | 5 (6%) | 8 (6%) | 0.24 |
| Cognitive impairment | 7 (9%) | 9 (6%) | 0.16 |
| **Charlson Co-morbidity Index (CCI)** | | | |
| CCI with age | 6.59 | 6.54 | 0.72 |
| CCI without age | 3.45 | 3.54 | 0.67 |
| **Operative procedure** | | | |
| Major amputation | 16 (21%) | 29 (21%) | N/A* |
| Minor amputation | 12 (16%) | 23 (17%) | |
| Angioplasty lower limb alone | 8 (10%) | 15 (11%) | |
| Minor amputation with angioplasty | 17 (23%) | 32 (24%) | |
| Endovascular aortic repair | 14 (19%) | 27 (20%) | |
| Open aortic repair | 2 (3%) | 4 (3%) | |

GSS: Geriatric Surgical Service
*Not applicable due to case-control cohort matching

**Table 1:** Patient characteristics

| Outcomes | GSS (n=75) | Control (n=135) | p value |
|---|---|---|---|
| Length of stay | 15.4 days | 20.8 days | 0.003 |
| Postoperative delirium | 10 (13%) | 14 (10%) | 0.315 |
| Congestive cardiac failure | 5 (7%) | 10 (7%) | 0.397 |
| Acute myocardial infarct | 5 (7%) | 8 (6%) | 0.887 |
| Nosocomial pneumonia | 8 (11%) | 19 (14%) | 0.325 |
| Nosocomial Urinary tract infection | 6 (8%) | 16 (12%) | 0.286 |
| 30-day readmission | 26 (35%) | 46 (34%) | 0.395 |
| 30-day mortality | 1 (1%) | 6 (4%) | 0.231 |

**Table 2:** Patient outcomes

## Discussion

An ageing population brings numerous challenges to the practicing surgeon, and this is magnified by the unique challenges of the patient population that vascular surgery attends to. It has previously been shown that age or comorbidities alone do not reliably predict poor outcomes in patients [21,22]. One prospective cohort study found that more than a third of all patients admitted to a vascular service suffered from geriatric syndromes and nearly half were considered frail [23]. The GSS was set up in our institution to help tackle these challenges, and this is the first prospective study of the impact of a GSS on vascular patients in an Asian centre, although others have demonstrated a positive impact on length of stay and functional recovery in the setting of surgery for colorectal cancer [24].

Our data shows that patients cared for by the GSS had a statistically significant shorter length of stay. This is similar to the findings in the Western literature as well as in a local setting [13,24]. This is likely due to a variety of different factors spanning medical, surgical and social. Partridge and colleagues also demonstrated a shorter length of stay, and suggested that this could be due to fewer post-operative complications, anticipation and resolution of potential social issues such as discharge and post-operative care, and streamlining of the patient pathway [10]. We observed this streamlining effect in some of our patients such as when potential discharge problems were identified and solutions worked out concurrently while the vascular surgical team focused on the acute surgical problem. This would have a significant impact in our current climate where there is an ongoing severe acute hospital bed crunch and extremely high bed occupancy rate in the restructured government hospitals.

Apart from these, there were several other factors which affected the length of stay. Examples of these include waiting for radiology slot (for patients requiring angioplasty), waiting for theatre availability (for emergency operations such as amputations), and waiting for discharge facilities such as community hospital or nursing home. We observed that some of these were minimised by having the GSS – such as by the geriatric nurse clinician assisting in community hospital placement.

Better preoperative detection and optimisation of medical problems also contributed to the reduced rate of surgical complications. In our study, we focused on the commonly encountered complications in the elderly such as pneumonia and urinary tract infections. Although there was a trend towards a lesser rate of complications in the GSS group, these did not meet statistical significance in our study. Other authors found significant differences in rate of postoperative delirium, postoperative cardiac complications and postoperative bowel and bladder complications [10]. In this study, the main cardiac complications in question were arrhythmias and acute coronary syndromes, while bladder and bowel complications were constipation or faecal incontinence. Our results are broadly similar although we did not look at the rates of bladder or bowel complications in our patients in this study.

Interestingly, our study showed a slightly higher rate of delirium (not statistically significant) among the GSS patients compared to the control group. This stands in contrast to the previously mentioned RCT and is potentially due to the improved recognition of delirium by the GSS [10]. One major challenge in caring for the elderly population in Singapore is that many of them speak different languages or dialects and are not proficient in English, which is used by all the healthcare team members. Detection of delirium can therefore be difficult for junior members of the healthcare team who may not have the experience to overcome this language barrier. As seen earlier, this did not have significant impact on the other outcome measures in our study. While one may anticipate an increase in the proportion of elderly who speak English in Singapore, thus improving this situation; the value of a multidisciplinary assessment in detecting and treating patients with delirium is quite clear from our study.

Our study was limited by its relatively small numbers due to ours being a single institution and a fairly short time frame since the onset of the GSS. We focused primarily on metrics associated with hospital stay (such as length of stay and complications) rather than functional status. This would be an interesting field to look at in future studies as functional status is of particular importance to vascular patients, and has been shown to be a key predictor of future surgical risk [25].

Cost effectiveness remains another possible avenue of future research. The establishment of a multidisciplinary team requires investment of resources into hiring and training the different members of the team, and it would be illuminating to compare this against the potential savings from the improved outcomes demonstrated. While placing a defined economic value on quality of life is not possible, an estimate is essential for the purposes of healthcare planning and decision making.

## Conclusion

Within our study population, elderly vascular patients who were acutely admitted had significantly shorter length of stay through a multi-disciplinary and collaborative model of care between the vascular surgical team and GSS. There was also a trend of decreased nosocomial infections and 30-day mortality. Given the aging patient profile in our practice and much of the developed world, this is a promising means of addressing the challenges inherent in managing this high risk patient population.

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