Geriatric trauma: resource use and patient outcomes

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Introduction: Elderly patients who suffer trauma have a higher mortality and use disproportionately more trauma resources than younger patients. To compare these 2 groups and determine the outcomes and characteristics of elderly patients, we reviewed patients in these 2 groups admitted and treated in our tertiary care provincial trauma centre. **Methods:** From the provincial trauma registry we selected a cohort of 40 geriatric patients (group 1) (≥ 65 yr of age) with an ISS of 16 or more who were admitted to and spent time in our trauma service for more than 48 hours and compared them with a similar randomly selected cohort of 44 patients (group 2) aged 20–30 years. Family physicians were contacted for follow-up of these patients 2 years after discharge. **We considered** length of hospital stay, complications, disposition of the patients and use of consultation services. **Results:** Patients in group 1 had a mean age of 72.1 years (range from 65–98 yr) and a mean ISS of 27.3 (range from 17–50). Patients in group 2 had a mean age of 26.3 years (range from 22–29 yr) and a mean ISS of 26.3 (range from 17–54). Hospital stay was significantly longer in the group 1: 34.5 days (95% confidence interval [CI]: 24–44 d) versus 21.6 days (95% CI: 15–28 d). More elderly patients experienced complications (35 v. 13, $p < 0.001$) and required medical consultations (35 v. 26, $p < 0.001$). In-hospital death rates were 8% (3 of 40) and 4% (2 of 44) respectively ($p = 0.3$). Fewer geriatric patients could be discharged home (35% [14 of 40] v. 27% [22 of 44], $p = 0.056$) or to rehabilitation facilities (28% [11 of 40] v. 34% [15 of 44], $p = 0.3$). Five geriatric patients were discharged to nursing homes ($p = 0.007$). Of the geriatric patients discharged to rehabilitation facilities or home, 75% were independent 2 years after discharge. **Conclusions:** Aggressive care for geriatric trauma patients is warranted, and resources should be directed toward rehabilitation. Based on our findings, we expect that creating a directed care pathway for these patients, targetting complications and earlier discharge, will further improve their outcomes.

Introduction : Les patients âgés qui subissent des traumatismes présentent un taux de mortalité plus élevé et utilisent énormément plus de ressources des services de traumatologie que les patients plus jeunes. Pour comparer ces deux groupes et déterminer l'évolution de l'état de santé des patients âgés et leurs caractéristiques, nous avons étudié les dossiers de patients de ces deux groupes admis et traités dans notre centre provincial de traumatologie tertiaire. **Méthodes :** Nous avons sélectionné dans le registre provincial des traumatisés une cohorte de 40 patients en gériatrie (groupe 1) (≥ 65 ans) qui présentaient un indice de gravité de la blessure (IGB) de 16 ou plus, qui ont été admis dans notre service de traumatologie et qui y ont passé plus de 48 heures. Nous les avons comparés à une cohorte semblable sélectionnée au hasard constituée de 44 patients (groupe 2) âgés de 20 à 30 ans. Nous avons communiqué avec les médecins de famille au sujet du suivi de ces patients deux ans après leur départ. Nous avons tenu compte de la durée de l'hospitalisation, des complications, de l'état des patients et du recours aux services de consultation. **Résultats :** Les patients du groupe 1 avaient en moyenne 72,1 ans (intervalle de 65 à 98 ans) et présentaient un IGB moyen de 27,3 (intervalle de 17 à 50). Les patients du groupe 2 avaient en moyenne 26,3 ans (intervalle de 22 à 29 ans) et présentaient un IGB moyen de 26,3 (intervalle de 17 à 54). Les sujets du groupe 1 ont été hospitalisés beaucoup plus longtemps, soit 34,5 jours (intervalle de confiance [IC] à 95 % de 24–44 j) c. 21,6 jours (IC à 95 % de 15–28 j). Plus de patients âgés ont eu des complications (35 c. 13, $p < 0,001$) et ont eu besoin de consulter un médecin (35 c. 26, $p < 0,001$). Les taux de mortalité à l'hôpital se sont établis à 8 % (3 sur 40) et 4 % (2 sur 44) respectivement ($p = 0,3$). Moins de patients en gériatrie ont pu retourner à la maison (35 % [14 sur 40]

c. 27 % [22 sur 44], *p* = 0,056) ou aller dans un centre de réadaptation (28 % [11 sur 40] c. 34 % [15 sur 44], *p* = 0,3). Cinq patients en gériatrie ont quitté l'hôpital pour un foyer de soins (*p* = 0,007). Sur les patients en gériatrie qui sont allés dans un foyer de soins ou chez eux, 75 % étaient indépendants deux ans après leur sortie de l'hôpital. **Conclusions :** Le soin agressif des patients traumatisés en gériatrie est justifié et il faudrait affecter des ressources à la réadaptation. Compte tenu de nos constatations, nous prévoyons que la création d'une voie de soins directe pour ces patients qui viserait les complications et un congé plus rapide améliorera encore davantage l'évolution de leur état de santé.

Demographic studies have shown that geriatric trauma makes up a small proportion of trauma admissions.[1–3] Trauma in the elderly, however, is associated with higher mortality (despite less severe injuries), prolonged hospitalization and an increase in the number and severity of complications.[1,4–6] Elderly patients consume a disproportionate amount of trauma resources relative to their injuries.[1,2,4] Although many studies have shown that death rates are higher for geriatric patients, others have shown that the majority of severely injured elderly patients who survive their initial insult return to independent living.[7,8] These findings have been used to support aggressive trauma care policies for the elderly patient. Multidisciplinary care pathways have demonstrated benefits for both medical and surgical geriatric patients,[9–13] although there have been no studies looking at such a strategy in trauma patients.

We undertook a retrospective, cohort controlled study to determine the characteristics and outcomes of elderly trauma patients. From this we have attempted to determine what outcome measures future multidisciplinary care pathways should target.

Patients and methods

Vancouver Hospital and Health Sciences Centre, Vancouver General Hospital Site, is a 900-bed tertiary care teaching hospital with full specialty and subspecialty services. In addition to being the regional trauma centre, Vancouver General Hospital is also designated as the Adult Provincial Trauma Centre for British Columbia. All multidisciplinary trauma patients are admitted to a trauma service staffed by trauma surgeons (R.K.S., A.W.K., D.R.G.B.).

We reviewed the charts of trauma patients admitted to Vancouver General Hospital between July 1997 and March 1998 who were identified from the British Columbia Provincial Trauma Registry. The criteria for inclusion were as follows: patients sustaining multisystem trauma and aged 65 years or older or aged 20–30 years (the most frequently injured age group), an Injury Severity Score (ISS) of 16 or greater, and a hospital stay exceeding 48 hours. Because we were interested in knowing the outcomes of significantly injured elderly patients who survived the insult yet required hospitalization, we excluded patients admitted for less than 48 hours and those who died within 48 hours (6 elderly patients who died within 24 hours of admission during the study period and 8 younger patients who died).

Patient demographics, length of hospital stay (LOS), complications, disposition, time to disposition, use of consultation services, level of function on discharge and follow-up were analyzed. Patients' family physicians were contacted by phone or by letter 2 years after discharge to determine patient's level of function.

Findings were analyzed by the *t*-test for continuous variables and the χ^2 test for discrete variables. Significance was set at $p < 0.05$.

Results

We identified 40 patients aged 65 years or older who met study criteria (group 1). Thirty-nine patients were living independently at the time of admission. Forty-four younger patients meeting all other study criteria were randomly selected from 96 patients aged 20–30 years admitted during the same time period (group 2). All were functioning independently at admission. Patient demographics are outlined in Table 1.

Twenty group 1 patients and 12 group 2 patients experienced complications (Table 2). Seventeen group 1 patients experienced serious organ dysfunction (including respiratory failure, cardiac dysfunction, pneumonia, renal failure, delirium and alcohol withdrawal) compared with 6 group 2 patients ($p < 0.001$).

Group 1 patients, who survived more than 48 hours, had a similar in-hospital death rate to group 2 patients (8% [3 of 40 patients] v. 4% [2 of 44 patients]). The causes of death

Table 1

Demographic Information for the Study Patients

Demographic	Group 1 (*n* = 40)	Group 2 (*n* = 44)
Male/female	20/20	33/11
Age, yr		
Mean	72.9	26.0
Range	65–98	22–29
Mean Injury Severity Score	27.3	26.3
Predominant injury		
Head	15	9
Chest	6	3
Abdomen	2	2
Orthopedic	9	13
Burn	0	1
Spinal	8	16
Mechanism of injury		
Motor vehicle collision	13	24
Pedestrian struck	11	3
Fall	15	12
Assault	0	3
Hit by falling object	0	1
Explosion	0	1
Suicide attempt	1	0

Here and in all tables in this article, group 1 = trauma patients ≥ 65 years old, group 2 = control group of trauma patients 20–30 years old.
Values are numbers of patients unless otherwise indicated.

in group 1 were myocardial infarction (1 patient), head injury (1 patient) and aspiration (1 patient). The 2 deaths in group 2 were attributed to acute respiratory distress syndrome. Initially, there was a higher death rate for the elderly patients (13% v. 8%, p

Table 2

Complications Experienced by 20 Elderly Patients (Group 1) and 12 Younger Patients (Group 2) After Multisystem Trauma

Complication	Group 1	Group 2
Respiratory failure* (requiring ICU)	5	3
Pneumonia (no ICU)	4	2
Congestive heart failure/cardiac	3	0
Urinary†	9	4
Renal failure	1	0
Delirium	3	0
Wound infection	1	2
Confusion not yet diagnosed	5	0
Alcohol withdrawal	3	1
Other‡	3	1
Total complications	37	13§

*Patients with a diagnosis of respiratory failure due to pneumonia, congestive heart failure, pulmonary embolism and acute respiratory distress syndrome were not recounted in the categories of pneumonia or congestive heart failure. These patients required intensive care unit (ICU) consultation with or without intubation.
†Urinary tract infections or retention requiring treatment. Half of the elderly patients also had cardiorespiratory complications (e.g., pneumonia or myocardial infarction).
‡Organ dysfunction secondary to prolonged ICU stay for head injury, fever of unknown origin, and depression resulting in self-neglect.
§$p < 0.001$

Table 3

Consultations Obtained for the Study Patients

Type of consultation	Group 1 (n = 40)	Group 2 (n = 44)
Cardiology	3	0
Respirology	5	3
Nephrology	1	0
Intensive care	5	1
Rehabilitation + others	6	0
Rehabilitation only	7	17
Neurology	2	1
Infectious disease	0	1
Geriatric medicine	3	0
General medicine	3	3
Total consultations	35	26*

Nine group 1 patients and 8 group 2 patients had psychiatric consultations ($p = 0.365$).
*$p < 0.001$.

< 0.001), but when patients who survived the initial insult were adjusted for, there was no significant difference (8% v. 4%, $p = 0.29$).

A total of 24 group 1 patients and 22 group 2 patients required medical consultations (Table 3). Group 1 patients often required multiple subspecialty consultations (35 medical consults for 24 patients), whereas group 2 patients often required only a rehabilitation consultation (26 consults for 22 patients). Subspecialty medical consultations were all obtained for complications arising during hospital admission, except for 1 cardiology consultation that was for pre-existing disease. Two general medical consultations and 2 geriatric consultations were obtained for pre-existing conditions. Rehabilitation consultations were obtained in patients who were expected to require rehabilitation before discharge. These consultations addressed both medical and mobilization issues. Nine elderly patients and 8 younger patients required psychiatric consultations.

The average LOS was 34.5 days (95% CI: 24–44 d) for group 1 patients compared with 21.6 days (95% CI: 15–28 d) for group 2 patients ($p = 0.05$). Seven (18%) group 1 patients and 11 (25%) group 2 patients required admission to the intensive care unit (ICU) ($p = 0.22$). The mean number of days spent in the ICU were 1.65 for group 1 and 2.79 for group 2 ($p = 0.70$). Discharge level of care is outlined in Table 4. Five patients were transferred to a nursing home. Of these, 4 were older than 80 years.

The time to discharge for patients who remained in acute care surgical beds and who were designated as "alternate level of care (ALC)," (i.e., requiring rehabilitation or admission to a long-term care facility) was also recorded. The attending physician, in consultation with the patient care manager, made this ALC designation when the patient no longer required an acute care surgical bed. Eighteen group 1 patients and 9 group 2 patients were designated as requiring ALC ($p < 0.001$). The elderly waited a mean of 30.7 days for transfer, the younger patients 16.8 days.

When we contacted patients' family physicians 2 years after discharge, we found follow-up information was available for 12 of the 25 patients discharged to either rehabilitation facilities or home. Of these 12 patients, 9 (75%) still lived independently, 2 patients had died and 1 patient was living in a nursing home. Follow-up was unavailable for the remainder of the patients because either there was no family physician listed on the chart or the patient was no longer being cared for by the same family physician.

Discussion

This study has confirmed that geriatric trauma patients have a different mechanism of injury, more complications and greater resource requirements per admission (as measured by LOS and number of consultations) than 20–30-year-old patients with a similar ISS. However, this study failed to confirm an increased adjusted

Table 4

Functional Status of Study Patients at Time of Admission and Discharge

Functional status	Group 1 (n = 40)	Group 2 (n = 44)	p value
Independent at admission	39/40	44/44	
Died	3	2	0.29
Discharge home	14	22	0.056
Transfer to rehabilitation facility	11	15	0.30
Transfer to acute care hospital closer to home	7	5	0.19
Transfer to nursing home	5	0	0.007

death rate. The elderly patients who survived the initial insult had a similar death rate to younger patients. This is in contrast to the findings from the Major Trauma Outcomes Study (MTOS),[3] which showed a higher case fatality for the elderly with respect to every mechanism of injury and region of injury. However, the MTOS included patients with isolated hip fractures and isolated head injuries. Both of these are known to be associated with poorer outcomes in the elderly. Furthermore, the mean ISS in the MTOS study was 13.3 (both in elderly and younger patients). This group is not directly comparable to our study group of patients having multisystem injuries and a mean ISS of 27.3.

Functional outcome for geriatric patients has been debated in the literature. Oreskovich and colleagues[14] reported that 88% of their elderly trauma patients (age > 70 yr) did not return to their previous level of independence and that 72% required full nursing care. Other studies have had more favourable results, with 57%[15] and 67%[7] returning to independent living, and 78% returning home.[8] DeMaria and associates[15] attributed the marked difference in outcome between their patients and those in the series of Oreskovich and colleagues[14] in part to the higher number of patients with falls in the latter series. Our 2-year follow-up showed that the geriatric patients who were discharged to either rehabilitation facilities or home retained their independence 75% of the time. Only 8.3% of patients were living in a nursing home. Our findings support the more optimistic view that a good functional outcome is possible after geriatric multisystem trauma.

A previous series of elderly trauma patients reported that the subgroup of patients older than 80 years had a poorer outcome than the patients aged 65–79 years.[2] Of our 6 patients older than 80 years, 2 were discharged home, and 4 required nursing home care. These 4 patients waited an average of 30.8 days for nursing-home placement. Their average LOS was 45.5 days. These patients clearly have a worse outcome after multisystem trauma but represented only a small proportion (15%) of our geriatric trauma patients.

The increased LOS in elderly trauma patients has been attributed to an increased incidence and severity of complications, underlying health problems and the requirement for ongoing care. As expected, the elderly also required more alternative care resources (rehabilitation and extended care) and had to wait longer to access these resources. This is partially owing to a lack of rehabilitation resources available for the elderly in our region. There are long waiting lists for nursing home beds, but only 5 of our patients were awaiting transfer to extended-care facilities. The remaining 13 patients were awaiting rehabilitation resources. Although fewer younger patients wait for placement, the wait is shorter, which suggests a greater availability of resources for this age group.

At present, the elderly make up a small proportion of trauma admissions. However, our data suggest this group consumes a disproportionate amount of resources. Some series report that elderly patients consume 25%–30% of trauma dollars.[1,16] Although it is recognized that the elderly suffer different mechanisms of injury, respond differently to a given mechanism of injury and experience more complications, relatively little research has been done on trauma in the elderly. As our population ages, there will be a growing number of elderly trauma patients to be cared for. It may be necessary to develop different guidelines for these patients, as we have done for children. Elderly patients are able to return to independent living after serious trauma, and their specific care and rehabilitation requirements need to be addressed.

Studies looking at costs and cost-effectiveness in elderly orthopedic patients with hip fractures have shown that comprehensive discharge planning programs, psychiatric consultation and multidisciplinary teams have led to earlier discharge and significant financial savings.[10–13] Landefeld and associates[9] have shown that geriatric medical patients cared for in a special geriatric unit are less likely to require long-term care facilities than those cared for on standard medical wards. Developing multidisciplinary care pathways for elderly trauma patients may similarly result in improved outcomes and cost savings.

Conclusions

Geriatric trauma patients who survive their initial insult require a longer hospital stay and experience more complications than younger patients. Only a small proportion seem to require nursing home care, and after 2 years many patients will remain independent. The use of multidisciplinary care pathways to reduce complications and improve access to alternative care facilities may decrease the LOS and improve geriatric trauma outcomes. Aggressive trauma care for the elderly appears to be warranted.

Competing interests: None declared.

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SESAP Critique
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Category 10, Item 23

Primary thrombosis of the axillary-subclavian vein (effort thrombosis of Paget–Schroetter syndrome) develops in healthy young persons as a result of extrinsic compression of the subclavian vein, usually between the first rib and clavicle. The historical treatment of effort thrombosis is anticoagulation to reduce the risk of pulmonary embolus. This is not an optimal long-term treatment option, because 33% to 50% of patients have disabling symptoms such as arm swelling and fatigue after anticoagulation alone. Improved outcome has been reported with catheter-directed fibrinolysis at the time of initial presentation. Restoration of patency has been associated with a significant reduction in late symptoms. To prevent recurrent thrombosis, repeat venography should be performed to identify persistent compression sites. Surgical decompression usually involves first rib resection; clavicular resection is not necessary. Balloon angioplasty does not correct the extrinsic compression in most cases. Stent placement may be useful until surgical decompression can be performed, but the use of stents without surgical decompression has been associated with stent fracture.

When fibrinolysis is unsuccessful, patients should receive anticoagulation for four to six months. Subsequent venous thrombectomy is unlikely to be successful because of the adherent nature of the chronic thrombus in these cases. Left clavicular resection in patients with chronic thrombosis will not reduce the prevalence of late symptoms and may worsen the outcome as a result of interrupting collateral venous branches.

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