

## Surgery in the Elderly, Counting the Cost and Rising to the Challenge:

### A review

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#### ABSTRACT

*Increasing life-expectancy globally and in the Caribbean region has led to an increased proportion of the population being categorized as elderly. The ageing population frequently require elective and emergency surgical procedures often with considerable morbidity and mortality. The amount of strain this paradigm can cause in any healthcare system is a huge challenge for the coming generations. In the Caribbean Islands, these challenges are compounded by several unique factors. This article reviews the impact of ageing upon surgery and associated specialties including anaesthesia and intensive care, with special reference to the Caribbean healthcare sector and attempts to provide some suggestions to mitigate such challenges in the near future.*

**Keywords:** Elderly, frailty, mortality, surgery

## La Cirugía en los Ancianos — Evaluando el Costo y Poniéndose a la Altura del Desafío: Una Revisión

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#### RESUMEN

*El aumento de la expectativa de vida tanto a nivel mundial como en la región del Caribe ha llevado a una mayor proporción de la población en la categoría de ancianos. La población en proceso de envejecimiento frecuentemente requiere procedimientos quirúrgicos electivos y de emergencia, acompañados a menudo de considerable morbilidad y mortalidad. La tremenda tensión que este paradigma puede causar en cualquier sistema de salud representa un desafío enorme para las generaciones venideras. En las islas del Caribe, estos desafíos se agravan por varios factores únicos. Este artículo examina el impacto del envejecimiento en la cirugía y las especialidades asociadas incluyendo anestesia y cuidados intensivos, con especial referencia al sector de la salud del Caribe, a la par que persigue brindar algunas sugerencias para mitigar estos desafíos en un futuro cercano.*

**Palabras clave:** Ancianos, fragilidad, mortalidad, cirugía

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**Global volume of surgery**

The global volume of surgery continues to grow worldwide (1). Available data from The World Health Organization (WHO) member countries showed that in 2012 there were an estimated 300 million surgeries performed worldwide, which represented a 33% increase in surgeries from 2004 (1).

**Ageing and surgery**

The median life-expectancy and proportion of persons older than 65 years is increasing globally; with a global life-expectancy of approximately 72 years in 2015. Likewise, a similarly increasing trend is seen in many Caribbean countries (Fig. 1).

**Elderly patients and elective surgery**

In a meta-analysis looking at patients  $\geq 65$ -years-old having elective surgery, Watt *et al* found a postoperative complication rate of 25% (95% CI 18.26, 33.61) and an overall mortality rate of 4.58% [95% CI, 3.67, 5.71] (2). Reassuringly though, in elderly patients  $> 80$  years old, Hamel *et al* reported a mortality rate of  $< 2\%$  for many common surgical procedures such as hernia repair, knee replacement and trans-urethral resection of prostate [TURP] (3).

**Elderly patients and emergency surgery**

Compared to elective surgery, emergency surgery is generally associated with worse outcomes. In the



Fig. 1: Percentage of population greater than 65 years old, Total life expectancy and GDP per capita for the Caribbean regions, Trinidad, Jamaica and Barbados. (Raw data available from: <https://data.worldbank.org>)

United Kingdom National Emergency Laparotomy Audit (NELA), the unadjusted mortality rate after emergency laparotomy was found to be 15% overall and 24% in patients over 80 years of age (4). In fact, mortality increased by 4% for every ten-year increase in age over 50 years. Even acute appendicitis was found to be associated with a seven-fold increase in mortality in patients older than 70 years, compared to their younger cohorts (5).

### Elderly patients and anaesthesia risk

There has been a dramatic reduction in the overall anaesthesia related mortality over time. Mortality solely attributed to anaesthesia has been reduced to 34 deaths per million cases during the period 1990–2000, compared to more than 300 deaths per million cases before the 1970s (6). Specifically, in Brazil (a developing country) it was shown that there were no deaths attributed to anaesthesia alone out of more than 55 000 anaesthetic procedures over an eight-year period (7).

Anaesthesia in the elderly patient still poses many challenges for the anaesthesiologist. Inevitable age-related degenerative changes and decline in the cardiorespiratory and renal reserve will increase the risk of anaesthesia (8). In patients aged > 60 years, the intra-operative cardiac arrest rate was 100 per 10 000 cases, resulting in 68 deaths over a fifteen-year period (9). However, the majority of cases of cardiac arrest were due to the patient's pre-existing physical condition and not exclusively due to anaesthesia. Hence, the majority of elderly persons should be reassured that general anaesthesia is reasonably safe and surgical decision-making should therefore, encompass the entire perioperative period.

### Is advanced age really the issue?

Despite the increased morbidity and mortality that elderly people face when undergoing all types of surgery, chronological age may not be the main factor responsible for this. Stratifying elderly patients based on "frailty" may be a more important predictive tool.

### Frailty and increasing age

Frailty can be defined as, "a state of vulnerability to poor resolution of homeostasis following a stress and is a consequence of cumulative decline in multiple physiological systems over a lifespan," (10). The prevalence of frailty increases with age. In a Canadian study of community dwellers, 22% of persons > 65 years of age were

found to be frail, this number increasing to more than 40% in those > 85 years (11).

### Frailty and geriatric syndromes in the elderly surgical patient

In patients presenting for Emergency General Surgery (EGS) the incidence of frailty was reported to be more than 25% (12, 13). Joseph *et al* assessed frailty in 220 patients presenting for EGS using the Frailty Index (FI) and found that frailty was an independent predictor of major complications (Odds Ratio (OR) 3.9; 95% CI, 1.7, 8.8) which did not correlate to patient age and also poorly correlated with the American Society of Anesthesiologists (ASA) – physical status grade (13). In more than 35 000 patients presenting for EGS, Farhat *et al* also showed that frailty was an independent predictor of mortality [OR 11.7] (14).

In a meta-analysis of elderly patients undergoing elective surgery, Watts *et al* showed that the geriatric syndromes of frailty, cognitive impairment and depressive symptoms were associated with an increased risk of postoperative complications, OR 2.16 (95% CI 1.29, 3.62), OR 2.0 (95% CI 1.4–2.8) and OR 1.8 (95% CI 1.2, 2.6), respectively (2). Commonly assessed risk factors such as age and ASA grade were not associated with postoperative complications.

Sarcopenia, another geriatric syndrome associated with frailty and characterized by a progressive loss of skeletal muscle mass and strength is also strongly associated with postoperative complications (15).

### Measuring frailty

Frailty is one of the major factors that can determine surgical outcome. It is important to understand how one can measure it. The two main models of frailty are the phenotype and the deficit accumulation model (16). Many different frailty scales exist. Variables to consider in choosing a particular scale include the clinician using the scale (geriatrician *versus* non-geriatrician), setting (clinical *versus* research), time available and possible identification of modifiable risk factors. The research standard is generally considered to be the frailty index (16). However, this may not be practical in the clinical setting as it contains up to 70 items.

The Edmonton Frail Scale has been commonly used in clinical practice. It is validated for use by non-geriatricians and can assess multiple domains quickly (16).

In emergency surgery patients in whom frailty can be difficult to assess, sarcopenia as determined by psoas

muscle area and density on preoperative CT can be used to identify at risk elderly patients (15, 17).

Despite the many tools that may be available, in their systematic review which included 21 different frailty instruments, Lin *et al* found that regardless of the instrument used, frailty was still found to be associated with an increased mortality (18).

### **Intensive care in frail and elderly patients**

Many frail and elderly patients would be categorized as high-risk and would thus benefit from the intensive monitoring and organ support that can be provided in an intensive care unit (ICU). Decision to operate on high-risk elderly patients should not be made without a prior commitment to provide the appropriate level of postoperative care (8).

In patients > 80 years old admitted to the ICU, frailty was found in 43% of patients compared to 30% in a general ICU population (19, 20). As in surgical patients, frailty increases the risk of complications and mortality in the ICU patient.

In their meta-analysis Muscedere *et al* showed that frailty was associated with higher hospital mortality (RR, 1.7), one-year mortality (RR, 1.5) and reduced likelihood of home discharge [RR, 0.6] (20). In very old intensive care patients (aged  $\geq$  80 years), a multivariate analysis showed that both acute admissions and frailty are associated with a greater risk of death (HR 4.7) and (HR 1.5), respectively (19).

Even if they do survive to discharge, the majority of elderly patients (74%) may not recover their full physical function even up to one year post discharge (21).

Intensive care still plays an important role in managing high-risk patients although it is an expensive and limited resource, especially in the Caribbean setting. Healthcare institutions need to ensure that adequate ICU beds are available to accommodate the number of high-risk procedures being done at their institutions. Data from the United Kingdom (UK) has shown that regional variation in mortality may be explained by differences in ICU bed numbers (22). In addition, although high-risk patients account for more than 80% of surgical mortality only 15% were admitted to an ICU (23). The European Surgical Outcomes Study (EuSOS) showed that the majority of patients (73%) who died were not admitted to the Intensive Care at any time following surgery (24). Policy planners need to be aware of this key intervention.

### **Perioperative care provision**

Given the challenges of surgical interventions in elderly patients, multidisciplinary perioperative input would be the most appropriate care model. The American Society of Anesthesiologists perioperative surgical home (PSH) is an example of such a structured pathway (25). The PSH has been shown to reduce costs and improve outcomes in patients (26).

In the UK, the Royal College of Anaesthetists (RCOA) have also adopted perioperative medicine based care pathways (27). In a similar fashion, Anaesthesia Departments in the region should focus on increasing their input in these high-risk cases, not being restricted to the intra-operative period.

### **Interventions in frail patients**

With the identification of frailty as a risk factor for perioperative complications and mortality, research is underway on potentially modifiable factors. In addition, many of the screening tools can also identify which intervention a patient may benefit from. Commonly used interventions include exercise and nutritional therapy. Even depression and anxiety in elderly patients are risk factors for morbidity and mortality after surgery and are also potentially modifiable (28, 29).

### **Training and research needs**

Although the Caribbean produces a wide variety of medical specialist, specific training needs must continue to be addressed especially with regards to the management of the elderly patient (8, 30). Adopting a quality driven system similar to the National Health Service (NHS) in the UK can serve as a model to the Caribbean (31). In addition to audit and quality improvement work, long-term data on surgical outcomes in our frail and elderly patients should be actively studied and benchmarked against international cohorts. The value systems of our elderly patients should also be studied as this could lead to decisions that better improve patient quality of life rather than prolonging an inevitable post-operative demise.

### **Recommendations**

Specifically, elderly patients should be screened for frailty, as this can have important prognostic and therapeutic implications. Multidisciplinary perioperative consultations should be encouraged and local protocols developed. Consideration must also be given to

postoperative high-dependency unit or ICU admission in the high-risk, elderly surgical patients. For this to be feasible, hospitals must ensure an adequate number of ICU beds to meet their case mix and surgical volume.

Specific audit and quality improvement programmes should be advocated to advance care for this high-risk group. Local data on the outcomes of frail patients are greatly needed, as this can help inform decision-making to maximize the elderly patient's quality of life – which should be our primary perioperative goal.

## Conclusion

In the near future, a larger proportion of elderly and frail patients will present for elective and emergency surgery. While chronological age alone should not be used as a deterrent for surgery, being elderly puts patients at a greater risk for complications.

## REFERENCES

- Weiser TG, Haynes AB, Molina G, Lipsitz SR, Esquivel MM, Uribe-Leitz T et al. Estimate of the global volume of surgery in 2012: an assessment supporting improved health outcomes. *Lancet* (London, England) 2015; **(385 Suppl 2)**: S11.
- Watt J, Tricco AC, Talbot-Hamon C, Pham B, Rios P, Grudniewicz A et al. Identifying older adults at risk of harm following elective surgery: a systematic review and meta-analysis. *BMC medicine* 2018; **16**: 2.
- Hamel MB, Henderson WG, Khuri SF, Daley J. Surgical outcomes for patients aged 80 and older: morbidity and mortality from major noncardiac surgery. *J Am Geriatr Soc* 2005; **53**: 424–9.
- Saunders DI, Murray D, Pichel AC, Varley S, Peden CJ. Variations in mortality after emergency laparotomy: the first report of the UK Emergency Laparotomy Network. *Br J Anaesth* 2012; **109**: 368–75.
- Desserud KF, Veen T, Soreide K. Emergency general surgery in the geriatric patient. *The Br J Surg* 2016; **103**: e52–61.
- Bainbridge D, Martin J, Arango M, Cheng D. Perioperative and anaesthetic-related mortality in developed and developing countries: a systematic review and meta-analysis. *Lancet* (London, England) 2012; **380**: 1075–81.
- Pignaton W, Braz JR, Kusano PS, Modolo MP, de Carvalho LR, Braz MG et al. Perioperative and Anesthesia-Related Mortality: An 8-Year Observational Survey From a Tertiary Teaching Hospital. *Medicine* 2016; **95**: e2208.
- Griffiths R, Beech F, Brown A, Dhese J, Foo I, Goodall J et al. Perioperative care of the elderly 2014: Association of Anaesthetists of Great Britain and Ireland. *Anaesthesia* 2014; **69 (Suppl 1)**: 81–98.
- Nunes JC, Braz JR, Oliveira TS, de Carvalho LR, Castiglia YM, Braz LG. Intraoperative and anesthesia-related cardiac arrest and its mortality in older patients: a 15-year survey in a tertiary teaching hospital. *PloS one* 2014; **9**: e104041.
- Clegg A, Young J, Iliffe S, Rikkert MO, Rockwood K. Frailty in elderly people. *Lancet* (London, England) 2013; **381**: 752–62.
- Rockwood K, Song X, Mitnitski A. Changes in relative fitness and frailty across the adult lifespan: evidence from the Canadian National Population Health Survey. *CMAJ: Canadian Medical Association journal = journal de l'Association medicale canadienne* 2011; **183**: E487–94.
- McIsaac DI, Moloo H, Bryson GL, van Walraven C. The Association of Frailty With Outcomes and Resource Use After Emergency General Surgery: A Population-Based Cohort Study. *Anesth Analg* 2017; **124**: 1653–61.
- Joseph B, Zangbar B, Pandit V, Fain M, Mohler MJ, Kulvatunyou N et al. Emergency General Surgery in the Elderly: Too Old or Too Frail? *J Am Coll Surg* 2016; **222**: 805–13.
- Farhat JS, Velanovich V, Falvo AJ, Horst HM, Swartz A, Patton JH Jr et al. Are the frail destined to fail? Frailty index as predictor of surgical morbidity and mortality in the elderly. *J Trauma Acute Care Surg* 2012; **72**: 1526–30.
- Wagner D, DeMarco MM, Amini N, Buttner S, Segev D, Gani F et al. Role of frailty and sarcopenia in predicting outcomes among patients undergoing gastrointestinal surgery. *World J Gastrointest Surg* 2016; **8**: 27–40.
- Partridge JS, Harari D, Dhese JK. Frailty in the older surgical patient: a review. *Age Ageing* 2012; **41**: 142–7.
- Trotter J, Johnston J, Ng A, Gatt M, MacFie J, McNaught C. Is sarcopenia a useful predictor of outcome in patients after emergency laparotomy? A study using the NELA database. *Ann R Coll Surg Engl* 2018; **100**: 377–81.
- Lin HS, Watts JN, Peel NM, Hubbard RE. Frailty and post-operative outcomes in older surgical patients: a systematic review *BMC Geriatr* 2016; **16**: 157.
- Flaatten H, De Lange DW, Morandi A, Andersen FH, Artigas A, Bertolini G et al. The impact of frailty on ICU and 30-day mortality and the level of care in very elderly patients (>= 80 years). *Intensive care medicine* 2017; **43**: 1820–8.
- Muscudere J, Waters B, Varambally A, Bagshaw SM, Boyd JG, Maslove D et al. The impact of frailty on intensive care unit outcomes: a systematic review and meta-analysis. *Intensive Care Med* 2017; **43**: 1105–22.
- Heyland DK, Garland A, Bagshaw SM, Cook DJ, Rockwood K, Stelfox HT et al. Recovery after critical illness in patients aged 80 years or older: a multi-center prospective observational cohort study. *Intensive Care Med* 2015; **41**: 1911–20.
- Gillies MA, Power GS, Harrison DA, Fleming A, Cook B, Walsh TS et al. Regional variation in critical care provision and outcome after high-risk surgery. *Intensive Care Med* 2015; **41**: 1809–16.
- Pearse RM, Harrison DA, James P, Watson D, Hinds C, Rhodes A et al. Identification and characterisation of the high-risk surgical population in the United Kingdom. *Critical care* (London, England) 2006; **10**: R81.
- Pearse RM, Moreno RP, Bauer P, Pelosi P, Metnitz P, Spies C et al. Mortality after surgery in Europe: a 7 day cohort study. *Lancet* (London, England) 2012; **380**: 1059–65.
- ASA. Perioperative Surgical Home 2018 [Available from: <https://www.asahq.org/psh>].
- Garson L, Schwarzkopf R, Vakharia S, Alexander B, Stead S, Cannesson M et al. Implementation of a total joint replacement-focused perioperative surgical home: a management case report. *Anesth Analg* 2014; **118**: 1081–9.
- RCOA. Perioperative Medicine: The Pathway to Better Surgical Care [Available from: <https://www.roca.ac.uk/perioperativemedicine>].
- Ghoneim MM, O'Hara MW. Depression and postoperative complications: an overview. *BMC Surg* 2016; **16**: 5.
- Williams JB, Alexander KP, Morin JF, Langlois Y, Noiseux N, Perrault LP et al. Preoperative anxiety as a predictor of mortality and major morbidity in patients aged >70 years undergoing cardiac surgery. *Am J Cardiol* 2013; **111**: 137–42.
- Pearce L, Bunni J, McCarthy K, Hewitt J. Surgery in the older person: Training needs for the provision of multidisciplinary care. *Ann R Coll Surg Engl* 2016; **98**: 367–70.
- NHS. Improving quality and safety in healthcare 2017 [Available from: <https://improvement.nhs.uk/resources/improving-quality-and-safety-healthcare-collection/>].