ELSEVIER

European Journal of Cancer 40 (2004) 926–938

European Journal of Cancer

www.ejconline.com

Position Paper

The surgical management of elderly cancer patients: recommendations of the SIOG surgical task force

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Received 15 January 2004; accepted 19 January 2004

Abstract

Although cancer in the elderly is extremely common, few health professionals in oncology are familiar with caring for series of oncogeriatric patients. Surgery is at present the first choice, but is frequently delivered suboptimally: under-treatment is justified by concerns about unsustainable toxicity, whilst over-treatment is explained by the lack of knowledge in optimising preoperative risk assessment. This article summarises the point of view of the Surgical Task Force @ SIOG (International Society for Geriatric Oncology), pointing out differences from, and similarities to, the younger cohorts of cancer patients, and highlighting the latest updates and trends specifically related to senior cancer patients.

Keywords: Surgery; Solid neoplasms; Cancer in the elderly; Operative risk; Quality of life; Nutrition; Anaesthetics; SIOG

1. Introduction

Almost two-thirds of all solid tumours occur in patients aged 65 years or more, with most cancer-related deaths occurring in this age group [1–3]. There is much evidence that the increasing elderly population with cancer does not receive the potentially curative treatment afforded younger cancer patients [4], a view based partly on the perceived limitations to conventional treatments in the elderly [5,6], concerns about attendant serious comorbidity [7,8], and a reluctance by clinicians to incorporate older patients either into clinical trials of novel chemoimmunotherapeutic agents or into existing screening programmes [9–12].

The prevailing regional differences in treatments and screening practices, together with the complex reasons for exclusion from, or defaulting on, adjuvant therapies in older cancer patients, make for considerable variations in site-specific cancer survivals [13,14] and necessitate the establishment of guidelines for the standardisation of oncological care in the geriatric population [15].

This position paper summarises important treatment issues and considerations for cancer management in the geriatric population as part of our task force's continuing commitment to the provision of better cancer care in the elderly.

2. Definitions: what constitutes the elderly patient cohort

The definition of 'elderly' is controversial, with traditional demographic definitions including those patients exceeding 65 years of age. Census statistics show that this group represents about 12.5% of the population, although this proportion is expected to rise to nearly 40% by the year 2035 [16]. Agreement on what constitutes the elderly cancer patient is essential because

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doi:10.1016/j.ejca.2004.01.016

the community age structure itself is so dynamic [17]. This issue is somewhat complex, as there is an increase in the incidence of non-fatal cancers in the 'oldest old' (90 years and over) accompanied by a lower than expected incidence of metastatic disease, suggesting a form of protective effect in selected elderly subgroups [18].

Any assessment of cancer-specific outcomes where age alone functions as an independent variable needs to factor in age-adjusted life expectancy, implying benefit in dividing the elderly cohort into subgroupings of the young old, (65–74 years), older old (75–84 years) and oldest old (85 years and above) for the purposes of more accurate analyses. For our purposes, a definition of elderly is taken as age 70 years and over, representing the accepted age for such analyses in most studies. In this regard, age itself is not the most useful factor to consider, but rather the concept of senescence (the passage of biological time) as opposed to ageing (the passage of chronological time). This view has been increasingly recognised as of physiological importance when considering early operative mortality and morbidity in the risk categorisation for intermediate and major surgery where cancers are resected for cure [19–21].

2.1. Cancer epidemiology in the elderly

Despite a stable incidence of cancer over time, the prevalence of malignancy in old age (however defined) is expected to increase by nearly one-third over the next 30 years [22]. Although cancer-specific survival for a variety of solid epithelial malignancies is generally steeper in the elderly during the first year after diagnosis, the overall long-term survival appears to be independent of chronological age in many studies of visceral malignancies [23,24]. When all types of tumours are taken into account, the ratio between cancer incidence in those over 65 years of age compared with those between 55 and 64 years is 2.9 for males and 2.2 for females, although reported differences in site-specific cancer outcomes will reflect inherent regional variations in clinical stage at presentation, such that some non-staged older patients may be excluded from analyses. Age will also frequently affect the surgeon's view on extirpative surgery and the utilisation of preoperative neoadjuvant or postoperative adjuvant therapies [25].

In this respect there are few objective instruments for the determination of mortality risk in the elderly, given the high incidence of significant attendant comorbidity [7,26]. Promising initial results in categorising age-related chronic illness and functional disability with specific emphasis on their impact on cancer survival have been achieved with questionnaires independently designed by the University of South Florida, (the Comprehensive Geriatric Assessment Questionnaire; CGA) and the Italian Group for Geriatric Oncology (GioGer) [27,28].

In many cancers, age itself affects the predilection of cancer for site as well as for histological type; for example, there is a higher incidence of adenocarcinoma of the distal esophagus, well-differentiated gastric tumours, right-sided colonic cancer and low-grade lobular or mucinous breast tumours in the elderly than in younger cancer patients. These basic pathological differences will inherently affect outcome [29]. As already stated, for most types of solid epithelial tumours, old age itself does not appear to function as an independently negative prognostic variable for cancer-specific survival, a finding evident in recent studies of colorectal [21,30,31], gastric [32,33], oesophageal [34,35], liver cancer [36], head-and-neck [37,38] and breast cancer [39–42].

In each of these cancers, there are, however, more complex issues that impact on different age groups to affect overall and disease-free survival, some of which are addressed below. Screening programmes for the early detection of malignancies are now being developed and implemented, and in this respect there is evidence that a large proportion of subclinical malignancies will not be detected because they predominantly affect the older persons who are currently excluded from such programmes. In particular, women aged 70 years and over have the highest incidence and mortality from breast cancer of any age group, but despite this increased burden of disease it appears that older women are significantly less likely to be screened for breast cancer. Here, recent studies have reported that screening mammography actually reduces breast cancer mortality among women aged 65 years and older [43].

Equally, colorectal cancer (CRC), which is a leading cause of cancer death in developed countries, has a preponderance of elderly patients; the disease in those patients >80 years old accounts for one-quarter of all incident colorectal cancers and the burden of large-bowel cancer in this age group has risen by 70% in the last 20 years [44]. Despite this absolute risk, most pilot screening schemes are targeted at the younger age groups. The rationale for excluding older patients from CRC screening is possibly based on a seemingly limited life expectancy, as well as the perception of worse (or even poor) surgical outcomes in elderly cases, despite the fact that cancer screening in this group could potentially decrease the number of urgent cases and the incidence of advanced-stage presentations [45,46]. This approach may also change with the increasing use and sensitivity of new methods for the diagnosis of CRC in the elderly, such as computed tomographic pneumocolography [47,48] and virtual colonoscopy [49], although it is unclear as yet whether these new approaches are cost-effective [50].

2.2. Is the older cancer patient different?

2.2.1. Biological and physiological diversity with age

For several specific tumours, most notably breast, prostate and lung cancer, there is good evidence to suggest

that the tumour biology differs in various age groups, with variations in growth patterns and doubling times, intrinsic hormonal-receptor expression, DNA ploidy, tumour angiogenesis, the percentage of cells in the S-phase, p53 expression and the expression of extracellular matrix proteins [51–54]. Senescent tissues in general may also provide a microenvironment less capable of supporting rapid tumour growth, such that histologically identical tumours may behave inherently differently in older than younger patients [55–58].

This view should be balanced against the increased resistance to chemotherapy and the reduced remission period in the elderly for several cancers, including ovarian tumours and haematological malignancies [59–61]. Little is currently known about the subcellular changes involved in the ageing process as well as the effect particular ageing 'phenotypes' have on cancer susceptibility [62]. It is possible that regulatory genes that govern cellular senescence also control oncogenesis, an effect of particular importance in the immune system, where ageing alters the functional responses and surface characteristics of immunocytes infiltrating into tumours, as well as the attendant morbidity and mortality in the elderly following major surgery and the likely responsiveness to novel anticancer immunotherapies [63–69].

In 'normal' ageing the expected attenuation of the immune system involves an expansion of the natural killer (NK) cell population and those T lymphocytes that acquire a variable T-cell/NK-cell phenotype, along with variations in the Th1/Th2 lymphocyte cytokine production. The correlation between these changes and cancer development and progression is at present poorly understood [70,71]. This concept ties in with that of a 'first-hit', in which the older patient suffers prolonged exposure to tumour-associated antigens (TAA) with inherent immune 'exhaustion', and a 'second-hit' characterised by an absence of robust repair genes or the predominance of a 'frail' gene variant [72,73].

In relation to preoperative physiological status and chronic health, a series of scoring systems designed to assess the mortality and morbidity risks for patients undergoing intermediate and major operations when there is significant attendant preoperative comorbidity have recently been devised for use among patients where there is varied case mix. These systems include the ASA [74] and Karnofsky Performance Status [75], the APACHE scores [76,77], the POSSUM [78] and p-POSSUM gradings [79], and a range of mortality-prediction models [80,81]. Although these scoring systems all take age into account and provide validated estimates of preoperative risk based on pre-existing cardiopulmonary disease, they have not been validated either in the elderly patient or in elderly patients specifically undergoing cancer surgery [82–84].

To minimise the risk of a major selection bias in recruiting and presenting surgical data on elderly cancer patients, an international project has been launched with the aim of defining the general health condition of candidates for oncogeriatric surgery (PACE; Preoperative Assessment of Cancer in the Elderly). A comprehensive geriatric assessment is performed and the results are compared with the scoring systems at present available. A pilot study has been completed, and has proved feasible and inexpensive [85]; its aims were to clarify which patients should be considered for the various treatment modalities and to identify the small group of unfit individuals who should be excluded from certain radical extirpative procedures. Further expressions of interest for this project are welcome.

2.2.2. *Differences in stage at presentation*

Site migration is well known among patients with colorectal and gastric cancer: gastric cancer is more likely to affect the distal part of the stomach amongst the elderly [86–90] and right-sided colon carcinoma shows a 2-fold increased frequency in older patients when compared with younger cohorts (33% versus 16%) [91–94]. These anatomical differences translate into variable signs and symptoms at presentation, which are therefore somewhat age specific. The effective 'biology' of these tumours will therefore vary with age even when site and stage are relatively controlled, such that gastric cancers in older patients tend to be smaller and more differentiated even though they often have a higher incidence of subserosal invasion and lymph-node metastases [95].

A separate but related issue is the suboptimal staging that elderly patients receive before treatment. Barchielli and colleagues have shown a 3-fold decrease in the prevalence of stage III breast cancer in older patients (59% versus 22% in the $\geqslant$80-year-old group) and have noted that axillary staging was not performed at all in the over-80 age group [96]. Moreover, robust epidemiological data are now available indicating that the elderly are undergoing less extensive preoperative and pretreatment diagnostic investigations. In this respect, De Rijke and colleagues have demonstrated that a larger proportion of cases with unknown tumour stage and a higher proportion of patients without histologically or cytologically confirmed diagnoses are found amongst the oncogeriatric group [97–99].

2.2.3. *'Frailty' as a concept in the geriatric patient*

Although the term 'frail' is almost a quarter of a century old, its medical meaning is still undefined. In the medical literature it often is thought to represent dependency in someone with poor physiological reserves who has a high prevalence of repeated chronic illnesses and hospital admissions, and who may have complex medical and psychosocial problems as well as limited social support. This state is coupled with an increase in the age-related prevalence of significant

cardiac and respiratory comorbidities, together with major functional impairment, which among the elderly increases the risk of treatment-related complications and cancer-specific mortality [7,100–107]. The lack of sound, evidence-based information on the treatment of elderly patients with cancer can directly affect clinical practice [108,109], a feature that has been responsible in the past for excluding a significant number of geriatric cancer patients from surgery, radiotherapy and chemotherapy [9,110].

2.2.4. Nutritional aspects

Malnourishment is highly prevalent amongst the 'healthy' geriatric population, among which it can affect up to 12% of males and 8% of females [111], and where nutritional deficiencies are demonstrable in up to 60% of hospitalised elderly in Europe [79]. These findings have an impact on cancer-specific outcomes and mortality statistics, as a 6-fold increase in surgical complications has been reported in patients who are defined with preoperative malnutrition [112]. Essentially, the nutritional support of elderly cancer patients follows the same recommendations, indications and routes of access that apply to non-elderly cancer cohorts, but, the nutritional regimens utilised have some specific variations with regard to caloric requirements and substrate supplementation.

With respect to water infusion, the basic clinical tenet has been that elderly patients have a relatively poor tolerance to fluid and sodium overload. Quite recently, Lobo and colleagues [112] have demonstrated that in an adult surgical population, postoperative restriction of fluid (to no more than 2 l water and 77 mmol sodium per day compared with 3 l water and 154 mmol sodium or more per day) was beneficial for the passage of flatus and stool after gastrointestinal cancer surgery and for the length of hospital stay. A prudent regimen for the elderly should include no more than 30 ml/kg water and 1 mmol sodium per kg per day, provided the pathological losses are adequately offset.

There is some confusion in the literature on the energy requirements of older people. For this group, the resting energy expenditure is lower than in non-elderly adults (when expressed per kg body wt), simply because ageing is associated with a change in body composition resulting in a relative increase in fat together with a relative decrease in body cell mass. As body cell mass is the metabolising, oxygen-consuming portion of the fat-free mass (and it is closely related to skeletal muscle mass), when the basal metabolic rate is expressed in terms of units of body cell mass, there is no effect of age. Here muscle (which accounts for 20–25% of resting energy expenditure) may be diminished in real terms in the elderly patient who expends less physical energy.

From a practical point of view an adequate nutritional regimen should include 30–35 kcal/kg per day, despite this low total energy expenditure and reduced physical activity, where this caloric intake is required to meet the extra demand of the disease (malignancy, surgical trauma, infection, temperature and so on) as well as to restore the body cell mass already reduced in depleted patients. This task, which is the same for all adults, is, however, made more difficult in patients over 65 years of age. When planning nutritional support we would suggest that fat should account for 35–50% of total calorie intake and that higher doses might be provided during acute illness, with a fat limitation to about 30% of the total energy requirement for long-term artificial nutrition.

The rate of protein turnover and synthesis is modestly reduced on a weight basis but protein synthesis and degradation increase in the elderly when expressed in units of body cell mass. The recommended amount of administered amino acid in normal conditions should be at least 1–1.2 g/kg per day and up to 1.5 g/kg per day in sick and catabolic elderly patients. It has recently been reported [113] that elderly volunteers (mean age 75.4 years) receiving daily supplementation with arginine, glutamine and β-hydroxy-β-methylbutyrate for 7–14 days showed a significant increase in collagen deposition in subcutaneous polytetrafluoroethylene tubes compared with controls receiving an isonitrogenous and isoenergetic supplementation of non-essential amino acids. The effect as wound-healing promoters of similar specialised mixtures demands further research in the elderly.

2.2.5. Psychological issues and information on cancer

Psychological distress and coping with a cancer diagnosis are also particular to the elderly person. Younger women are considered to be less successful in maintaining a positive attitude in the face of a diagnosis of cancer [114,115]. It was also shown that elderly patients tend to have developed effective skills designed to manage stress, with reduced vulnerability for mental health and psychological functioning [116,117]. Although old age is a risk factor for depression and suicide [118], the elderly cancer patient responds in general more positively to organ-sparing treatments [119,120] and it has been shown that there is no difference in the quality of life after cancer diagnosis as a function of age [121]. An investigation on elderly breast cancer patients by Sandison and colleagues [122] showed that such patients desired involvement in decision-making for cancer therapy, and only a small minority were prepared to consider lesser and substandard treatments. Here, the majority of older patients opted for breast-sparing surgery with adjuvant treatment.

Another important point concerns the technique of information delivery to the patient by the cancer clinician in relation to the patient's involvement in decision-making for therapy. Ageism would appear negatively to affect this unique relationship between the cancer physician and older patients; Radecki and colleagues

found that physicians spend significantly less time with older patients than with younger ones [123]. Nevertheless, elderly patients seem to be more satisfied with the communication afforded by their doctors concerning their cancer and its therapy when compared with younger patient cohorts [124]. Cassileth and colleagues [125], in evaluating patient preferences on the level of information provided and the desire to participate in treatment decision-making in a study repeated over a 10-year interval to assess changing patient and doctor attitudes, showed that more patients desired complete information about their disease and its therapy over the duration of the study and that the vast majority were interested in full disclosure (good or bad news), insisting on active participation in their treatment decisions. In this respect, the percentage of patients over 60 years of age who preferred active participation (as opposed to leaving the decision to their physicians) rose from 51% in 1979 to 68% in 1989.

These and similar studies appear to endorse the need for practitioners to change their stereotypical perceptions of the cancer patient based on age. A further prospective investigation by Rothenbacher and colleagues [126] has shown that individuals with limited mobility were significantly less interested in knowing that they had cancer when compared with those who were able to walk independently either unaided or with a stick (7% versus 28%, $P = 0.002$), a finding of some importance, as pretreatment mobility reflects both independence and performance status. In contrast, a further study by Ajaj and colleagues [127] failed to confirm that social supports were important independent factors for cancer management; no significant differences in attitude towards being told about cancer were found between those either living with or without a partner. These issues are complex, as there are extraneous factors that affect the elderly patient's attitude and perceptions, including the physical ability to arrange for their own care (particularly through adjuvant regimens) and fears about their disposition after such therapy, such as the likelihood of transfer to a nursing home and its attendant loss of autonomy and independence [128].

There is no inherent formula for predicting the patient's response either to the diagnosis or the treatment of cancer in the elderly and it remains to be seen whether a comprehensive multidimensional assessment (as advocated by the PACE group), which incorporates an assessment and evaluation of psychological, social and support systems, can be developed. This concept is not new [129] and demands a clearer understanding of how age itself influences the psychological state after the diagnosis of cancer, how social supports (or the lack of them) affect patient well-being as a function of age, what age-specific, cost-effective benefits are accrued by newer and experimental therapies for cancer, and how older patients perceive the risk calculus for such therapies once cancer has been diagnosed. Each of these factors will impact on the cost outlay for ancillary social services that lie outside hospital cancer care, such as the requirements for (and utilisation of) aftercare facilities, rehabilitation services and service access to such facilities based on age.

3. Optimising surgical management

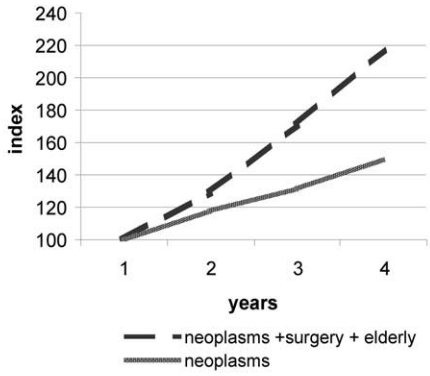
3.1. Educational opportunities

A growing interest in the management of the older cancer patient has developed in concert with dedicated meetings and courses, targeting the elderly, arranged by SIOG and the European School of Oncology [130,131]; the subspecialty of geriatric oncology was included in the primary conference structure during the recent 2003 ASCO Annual Meeting [132,133]. Fellowships and grants have been made available through this society 'to ensure a future of quality care and treatment for ageing individuals with cancer'. A large part of this new interest has been focused on medical oncology, with little emphasis on the surgical events surrounding geriatric oncology. A PubMed search was recently performed to investigate the volume of scientific reports published on the surgical management of cancer in the elderly for the years 1982–1986, 1987–1991, 1992–1996, 1997–2002 using the search engines *neoplasms* AND *surgery* AND *elderly*; there has been a substantial increase in the number of surgical papers, rising from 13 392 in 1982–1986 to 29 157 papers in 1997–2002 (a 118% increase). To understand this increase better, a search was conducted for the same time intervals using the generic keyword *neoplasms*, which retrieved 235 294 articles for the first time interval and 352 559 articles for the latter 5-year period, an increase of some 50% (Fig. 1a,b). This provides some evidence of the steep increase of interest in the surgical management of oncogeriatric patients.

A closer interaction and enmeshing between surgeons and geriatricians has occurred over time, resulting in its specialist incorporation into the Fourth Edition of the American Surgical Resident Curriculum [134]; a recognised and accredited syllabus has been funded by the American Geriatric Society and the John A. Hartford Foundation focusing on the development of surgical geriatrics as a definitive subspecialty and as a legitimate research area [135–137].

4. Technical surgical advances: age differentiation?

Although technical surgical details do not essentially differ significantly with patient age, there are some specific recommendations that SIOG would proffer about cancer sites in the geriatric cancer population.



Keywords for PubMed search	1982-86	1987-91	1992-6	1997-2002
Neoplasms+surgery+elderly (% of increase)	13392	17331 (29%)	22889 (71%)	29157 (118%)
Neoplasms (% of increase)	235394	277291 (18%)	309877 (32%)	352559 (50%)

Fig. 1. (a) Graphical representation of the increase in articles as reported on PubMed. (b) Numbers of articles reported on PubMed for each 5-year period and percentage of increase on year 1.

4.1. Lung cancer

Half of all lung cancer cases present in patients of 65 years and over [138], and generally fewer surgical options are provided for this group with its presumptive expectations of increased frailty, less pulmonary reserve, a higher overall risk of significant postoperative complications and a projected reduced 'active' life expectancy [139]. Many of these assumptions reflect the differential treatment for lung cancer afforded by age alone, with little evidence base to support these views.

Thoracic surgery has been proved to be a safe and feasible alternative in well-selected groups of the elderly population. Since surgery offers the best chance of cure for patients with early-stage lung cancer, and given that the operative mortality of thoracotomy and pulmonary resection has attained acceptable rates, a reassessment of unit experience in the elderly is warranted [140–142].

Effort should be made to detect lung cancer at an earlier stage in older patients, such that there would potentially be an increased number of candidates suitable for minimal resections or for video-assisted thoracoscopic resection (VATS) [143]. Here, VATS offers advantages over thoracotomy in terms of reduced blood loss, less damage to the chest wall and minimal deterioration in performance status as reflected in the percentage post-operative changes in vital capacity and $FEV_{1.0}$. In the elderly, multivariate analysis identifies operative duration as an independent risk factor in performance deterioration and preliminary evidence suggests that in selected groups that there is no difference in long-term cancer-specific survival between the VATS and open-surgery groups [143].

The use of more limited lung surgery (such as wedge resections) too may further decrease operative complications in elderly patients when a lobectomy is precluded. Though lobectomy is still the ideal oncological operation for non-small cell lung cancer, wedge resections provide an adequate alternative in some patients with associated comorbidities [144].

4.2. Breast cancer

Age-related issues in breast cancer are particularly complex. Clearly, in selected elderly frail cases, hormonal treatment alone may be as effective in terms of cancer-specific survival when compared with surgery, although there is a higher progression rate of the primary if it is not removed [145]. In general, surgery appears well tolerated and is generally advised where possible, despite patient age [146].

Recent reports have suggested that older patients benefit from the same treatment plans as are afforded their younger counterparts [147], despite evidence that the treatment of many elderly patients is compromised for cure [148–150]. Axillary surgery has an established role in the staging and cure of breast cancer. The surgical management of the axilla in elderly patients has to be determined case by case, taking into account the patient's wishes; decisions will depend on the patient/tumour characteristics, available techniques and local expertise. The surgical management of the axilla used to differ in the elderly, with older patients generally receiving somewhat substandard treatment. For all patients with tumour size <3.0 cm (depending also on the size of the mammary gland) and no clinical evidence

of axillary involvement, sentinel-node biopsy is the standard approach in most countries. Data on this technique indicate that it can accurately predict the status of axilla, avoiding the unnecessary axillary dissection that will result in over-treatment for most patients [39,151].

In keeping with treatment standards, patients with tumours $\geqslant$3.0 cm with a clinically negative axilla, and those with any size of tumour and a clinically involved axilla, are recommended to undergo axillary lymph node dissection level I to level III, regardless of their age. The magnitude of the therapeutic benefit of removing axillary lymph nodes is debated, despite substantial evidence that axillary metastases can themselves metastasise and although chemotherapy is relatively unreliable in sterilising axillary disease [40,152,153] and axillary recurrence rates after axillary dissection appear lower than after axillary irradiation.

4.3. Gastric cancer

Aged patients with gastric cancer are often placed in the higher ASA classes for anaesthetic risk, owing to a higher prevalence of hypertension, electrocardiographic abnormalities, diminished nutritional status and coincident pulmonary disease [82,154]. This has resulted in conflicting resectability rates for gastric carcinoma in the elderly [33], although operative mortality is not significantly increased with advancing age [82]. Maehara and colleagues [155], who studied 344 patients who had had surgery for gastric cancer, have highlighted the fact that operative mortality has significantly reduced in recent years, with a marked drop in the most recent years. These data are of particular interest when considering that the ratio between partial and total gastrectomy has fallen from 60% to 40% in the 5-year period 1981–1990, whilst the ratio between R_0–R_1 and R_2–R_3 gastrectomies has increased from 25% to 75%. Although significant morbidity is slightly higher in the aged, these differences are not statistically different, and overall the prognosis of elderly patients with gastric cancer does not appear to differ significantly from that of younger people [156].

4.4. Colorectal cancer

Recently, the Association of Coloproctology of Great Britain & Ireland (ACPGBI) published two booklets on the unadjusted outcomes of CRC [157a,b]. In the first part of this study, a total of 73 hospitals contributed 8077 new CRC cases (emergency, urgent and scheduled) during a 12-month period, April 2000 to March 2001. The high prevalence of CRC amongst the elderly was confirmed (65–74 years, 30.7%; 75–84 years, 29.9%; $>$85 years, 9.3%); the recorded mortality rates were 3.3% in the $<$65-year age group, progressively increasing to 5.9% in the 65- to 74-year-olds, 10.7% in those aged 75 to 84 years and 14.8% in the $>$85-year age group. When the likelihood of developing an adverse outcome was considered in this initial data, it was shown that patients in the 65–74 age group were 1.8 times more likely to die following surgery, compared with 3.5 times for those of 75–84 years and 5 times for the $>$85-year group. These odds ratios were not, however, adjusted for all the other risk factors (ASA, site and stage) and should be interpreted with some caution. These issues are complex, but a later study presented by the same group confirmed that older patients have slightly worse cancer-specific outcomes, in keeping with the report of the Colorectal Cancer Collaborative Group that elderly patients have a higher incidence of comorbid conditions, present with later-stage disease and have more frequent emergency surgery [158].

The aims of this study were to standardise the outcomes for CRC across the United Kingdom with reference to a central database set, although the validity and the reliability of these newer instruments need to be determined prospectively.

Elderly patients with CRC are still presenting as surgical emergencies (obstruction and/or perforation) in up to 40% of cases, with a higher reported incidence of palliative operation and a lower overall utilisation of neoadjuvant preoperative and adjuvant postoperative therapies, each of which will influence long-term cancer-related outcomes [159,160]. Indeed there is very little rationale for substandard treatment delivery in colorectal emergencies, as long-term cancer-specific survival rates do not differ according to the patient's age under elective conditions [30,82].

Consideration should be given to alternative therapies for CRC emergencies; most notably, emergency (and semi-emergency) endoscopic stenting, although the mortality and the cost of this approach in the elderly cohort with comorbidity are at present unclear [161–163]. One of the most significant improvements in outcome for rectal cancer has been the introduction of total mesorectal excision (TME). TME, with its large decline in local recurrences, has become the new standard of operative management for rectal cancers, replacing conventional resections [164]. Recent investigations confirm our previous quality-of-life findings, that functional results as well as manometric recordings after low anterior resection and TME in the elderly are no worse than in younger patients [165–167].

Laparoscopic-assisted colectomy (LAC) too has emerged as a minimally invasive surgical strategy for diseases of the colon. Early reports have shown this is a viable option and some elderly patients with CRC have been treated as part of these protocols [168]. The safety and efficacy of LAC remain unclear, awaiting the final results of trials designed to examine whether it is an effective alternative to open colectomy in the prevention of recurrence and cancer death. Although there are theoretical benefits in utilising this technique in the

older cancer patient, only minimal and short-term quality-of-life benefits for LAC over standard open colectomy have been found in initial studies [169–171].

Transanal excision of low rectal cancer in selected patients is an acceptable alternative to formal resection. The recent development of transanal endoscopic microsurgery (TEMS) has permitted removal of tumours from the upper rectum. Important selection criteria include early T-stage, good or moderate differentiation, relatively small tumour size and negative microscopic margins [172], which are factors important in curative resections, although criteria for deliberately palliative endorectal resections may be relaxed in selected elderly patients. Local recurrence and survival rates appear similar to those for TME in early rectal cancer when TEMS is used with curative intent [173–175].

4.5. Liver cancer

Perhaps the most striking example of recent surgical advances in cancer is hepatic resection for both primary liver tumours and hepatic metastases. One-fourth of the hepatic resections in the early reports by Fortner and colleagues [176] were performed in patients >64 years of age, among whom operative mortality increased significantly with advancing years (11.1%, compared to 0.7% amongst patients up to 55 years and 3.6% in the group who were 55–64 years old). When formal extended right hepatectomy was excluded from the analysis, the cumulative operative mortality rate for patients >64 years of age was 7.6%, with hepatic failure being the most prevalent and most significant complication. The authors concluded that better methods of estimating hepatic functional reserve are needed, as 60% of the perioperative deaths were secondary to hepatic insufficiency. These assessments are of importance, particularly when hepatectomy is accompanied by short periods of deliberate vascular inflow occlusion resulting in ischaemia/perfusion injury [177].

In this respect, a large series from the MSKCC compared 128 liver resections in a consecutive series of elderly patients (median age 73 years; range 70–87 years) treated for colonic metastases [178], thus minimising the additional risk factors of cirrhosis and hepatitis. Here, the operative morbidity (42%), mortality (4%), the admission rate to intensive care (8%) and the average hospital stay (13 days) did not differ significantly from those in a group of younger subjects, nor were the 1- and 5-year cancer-specific survival rates different between these groups. Similar results have been achieved for primary hepatocellular carcinoma in non-cirrhotics [179,180] and in cirrhotic cases [181]. This effect has been translated into equivalent outcomes in the elderly patient undergoing formal hepatectomy, in whom survival is dependent upon the severity of post-operative liver failure consequent upon the extent of hepatic resection [182]. In this respect, in both primary and secondary liver cancer, older patients in some series have tended to have smaller tumours, with a trend towards more non-anatomical wedge resections and towards closer surgical margins of resection [36,182]. We can conclude from these data that chronological age alone is not a contraindication to extensive liver procedures, although elderly subjects have a higher post-operative morbidity and mortality, particularly if they have undergone formal hepatic lobectomy. Moreover, it would appear in selected cases that neoadjuvant chemotherapeutic strategies using newer agents (such as Oxaliplatin) are associated with long-term survival in initially unresectable metastatic disease from colorectal primaries where there is ultimately an aggressive policy of resection for metastases [183,184].

4.6. Anaesthetic considerations in the elderly cancer patient

The management of elderly patients is frequently an anaesthetic challenge [185], particularly as up to 50% of octogenarians undergoing non-cardiac cancer surgery have a history of hypertension, with 30% having coronary artery disease, 29% cerebrovascular disease, 23% chronic lung disease, 17% prior arrhythmias, 15% congestive heart failure and 12% diabetes [186]. The risk of perioperative complications is proportionately increased because the number of comorbidities and the relative risk of severe complications and death are significantly greater in geriatric patients than in younger cohorts [187], even though data for the 'oldest olds' are still not available from most centres.

Although general anaesthesia remains the 'gold standard', several procedures (including simple mastectomy) can be performed under local anaesthesia in patients with a poor preoperative state, given the limitations on the performance of such procedures as axillary dissection and the potential systemic toxicity of high dosages of local anaesthetic agents [188]. Epidural anaesthesia has also successfully been utilised in many elderly cases, with less effect on postoperative pulmonary [189] and cognitive [190] function, as has paravertebral blockade in selected cancer operations if the required expertise is available [191].

5. Conclusions

Knowledge about the surgical management of older cancer patients is rapidly expanding. While the older population should not be restricted from programmes for early detection and screening, evidence should be provided in favour of an advantage for quality of life, since a limited benefit in survival cannot justify a sharp deterioration in overall well being.

A multicentre cooperative investigation is continuing, with the aim of optimising preoperative assessment. The

lack of a reliable instrument for risk assessment is crucial, as there is evidence that fit elderly cancer patients are frequently under-treated on the one hand and a number of 'poor surgical risk' candidates are offered an ineffective, painful and unnecessary surgical procedure on the other hand.

Geriatricians should take an active part in the management of older cancer patients, as should clinicians with specific competence and expertise in cancer (anaesthesiologists, intensivists, cardiologists). Cancer in the elderly is progressively developing into a subspeciality on its own and a team approach towards management is obviously the way forward. Several educational projects and scientific events are taking place on this topic; it is our responsibility accurately to prepare the next generations of surgeons for the expected changes in surgical routines as part of specific oncogeriatric practice. Public opinion, the media, economists and politicians should acknowledge this major international effort and fund-raising bodies should take an active role in the development of appropriate proven strategies.

Acknowledgements

This position paper has been approved by the Board of SIOG.

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