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Palliative geriatric assessment in selection of older patients with resectable pancreatic ductal adenocarcinoma for surgical treatment

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Abstract

Background

Surgical treatment of older patients with resectable pancreatic ductal adenocarcinoma (PDAC) is limited by comorbidities, frailty, and risk of postoperative functional deterioration. The study aimed to evaluate factors influencing shared decision-making in treatment allocation of geriatric patients with resectable PDAC and to compare survival and postoperative outcomes according to treatment strategy.

Methods

Patients older than 65 years with primary resectable PDAC were prospectively enrolled. Patients were either directly indicated for surgery by a surgeon or referred for comprehensive palliative geriatric assessment when surgical fitness was uncertain. Patients assessed as fit underwent pancreatic resection, whereas unfit patients received oncologic and palliative treatment. Clinical, functional, and quality-of-life parameters were analysed. Multivariate logistic regression included age-adjusted Charlson Comorbidity Index (aaCCI), Instrumental Activities of Daily Living (IADL), Karnofsky Performance Status (KPS), and selected EORTC QLQ-C30 variables.

Results

Sixty-nine patients were included; 19 directly selected for surgery (Control group- C), 22 assessed as fit after geriatric evaluation (Intervention group - I), and 28 assigned to palliative treatment (Palliative group- P). Median overall survival (mOS) did not significantly differ between groups (7.5 vs. 14.26 vs. 16.3 months; P vs I, p = 0.054; I vs C, p = 0.63; P vs C, p = 0.058). When we compared mOS of all operated patients (C + I) versus palliative group, the difference reached statistical significance (16,3 months vs 7.5 monhts, HR = 1.78, 95% CI 1.08–2.92, p = 0.02). Length of intensive care unit stay, severe postoperative complications, and chemotherapy administration were comparable. Significant differences between intervention and palliative groups were found in aaCCI (p = 0.016), IADL (p = 0.025), KPS (p = 0.001), fatigue (p = 0.042), and physical functioning (p = 0.028). Multivariate analysis identified aaCCI and IADL as independent predictors of treatment allocation.

Conclusions

Comprehensive palliative geriatric assessment supports shared decision-making and may help identify older patients suitable for pancreatic surgery despite initial concerns regarding frailty. aaCCI and IADL represent practical clinical parameters for surgical selection; further validation in larger cohorts is required.

Introduction

Pancreatic cancer accounted for 510,990 new cases worldwide in 2022 and its incidence is expected to rise to 998,660 by 2050 according to GLOBOCAN (Global Cancer Observatory) data [1]. Among gastrointestinal malignancies, pancreatic cancer shows one of the fastest rising trends in both incidence and mortality [1]. The median age at diagnosis is 71 years, reflecting the growing impact of pancreatic cancer in the aging population [1]. Despite this demographic reality, elderly patients remain underrepresented in clinical trials evaluating pancreatic cancer treatment, with the median age of enrolled patients reported to be approximately six years lower than that observed in the general population [2]. Consequently, evidence guiding treatment decisions in geriatric patients remains limited.

Pancreatic surgery is a technically demanding procedure associated with postoperative complication rates approaching 30% and perioperative mortality 1–3%, even in high-volume centers [3]. Current studies addressing treatment decision-making in older patients mainly focus on postoperative outcomes and survival after surgery. [4, 5, 6]. However, data describing treatment trajectories and outcomes of patients deemed unfit for surgical intervention remain scarce [4, 5, 6].

Comprehensive geriatric assessment and other measures has been proposed as a tool to evaluate functional reserve, frailty, and treatment tolerance beyond chronological age [7, 8, 9]. Integration of palliative care principles into the preoperative evaluation may further support shared decision-making by incorporating patients' functional status, symptom burden, and individual goals of care. Nevertheless, the role of structured palliative geriatric assessment in selecting elderly patients with resectable pancreatic ductal adenocarcinoma for surgery has not been sufficiently explored.

The aim of this study was to evaluate factors influencing shared decision-making in treatment allocation of older patients with resectable pancreatic ductal adenocarcinoma and to compare survival and treatment outcomes according to treatment strategy.

Material and Methods

2.1 Study design and patients

This single-center study was conducted at the National Cancer Institute, Bratislava, Slovakia, between 2019 and 2024. The study included patients older than 65 years with newly diagnosed primary resectable pancreatic ductal adenocarcinoma (PDAC). Patients were initially evaluated by a pancreatic surgeon. Patients considered clearly fit were directly indicated for pancreatic surgery (control group, C). When surgical fitness was uncertain, patients were referred to an outpatient oncologic palliative care clinic for comprehensive palliative geriatric assessment.

The study cohort consisted of 50 consecutive patients referred for palliative geriatric assessment prior to planned surgery and 19 patients who underwent surgery without such assessment (Fig. 1). The study

was conducted in accordance with the Declaration of Helsinki and approved by the institutional ethics committee.

2.2 Palliative geriatric assessment and intervention

The outpatient oncologic palliative care clinic provides early integrated palliative care for cancer patients at all disease stages. The assessment was performed by a palliative care physician who is also a medical oncologist. Comprehensive palliative geriatric assessment included: detailed medical history and symptom evaluation, physical examination, Instrumental Activities of Daily Living (IADL), age-adjusted Charlson Comorbidity Index (aaCCI), Karnofsky Performance Status (KPS), pain intensity assessed using Numeric Rating Scale, body mass index (BMI), echocardiography and pulmonary function examination, laboratory testing (liver enzymes, cholinesterase, bilirubin, albumin, CRP, CA19-9, creatinine). Patients completed quality-of-life questionnaires EORTC QLQ-C30 (version 3) and EORTC PAN26 at the initial assessment [10].

Following evaluation, a structured consultation with the patient and family members focused on disease understanding, treatment options, risks and benefits, symptom burden, and individual goals of care. Shared decision-making was used to determine the treatment strategy. Patients assessed as fit underwent pancreatic resection (intervention group, I). Patients considered unfit received oncologic treatment and specialist palliative care (palliative group, P).

2.3 Study outcomes and eligibility criteria

Patients eligible for inclusion were aged ≥ 65 years, had newly diagnosed resectable pancreatic ductal adenocarcinoma, were evaluated by a pancreatic surgeon at our institution, and provided informed consent for palliative geriatric assessment. Exclusion criteria included age < 65 years, non-PDAC histology, borderline resectable or unresectable disease, and patient refusal of palliative geriatric assessment.

The primary endpoint was overall survival among three groups of geriatric patients with resectable PDAC:

- patients directly selected for surgery by surgeon (control group, C), (n = 19),
- patients assessed as fit for surgery after palliative geriatric assessment (intervention group, I), (n = 22),
- patients considered unfit or unwilling to undergo surgery and treated with palliative care (palliative group, P), (n = 28).

Overall survival was defined as time from date of diagnosis to death from any cause. Secondary endpoints included postoperative complications, administration of oncologic treatment, quality-of-life parameters, length of stay at intensive care unit (ICU), and rates of adjuvant or palliative chemotherapy. Postoperative complications were classified according to the Clavien–Dindo classification [11].

2.3. Data collection

Clinical data were obtained from the hospital information system of the National Cancer Institute. Collected variables included demographic characteristics, laboratory parameters (albumin, cholinesterase, CA19-9), functional status (IADL, aaCCI, quality of life questionnaires), surgical characteristics, postoperative complications, length of stay at ICU, administration of adjuvant or palliative chemotherapy and overall survival. Patients were followed from the date of diagnosis until death or 31st December 2024, whichever occurred first.

2.4. *Statistical analysis*

Descriptive statistics were used to summarize baseline characteristics. Continuous variables were expressed as median and interquartile range (IQR), and categorical variables as absolute numbers and percentages. Each group was characterized by calculating proportional representation, median and interquartile range in each category. Overall survival was analysed using Kaplan–Meier curves and compared between groups using the log-rank test. Due to moderate sample size, selected clinically relevant variables were prescreened using univariate analysis with Bonferroni correction for multiple testing. Variables reaching statistical significance were entered into multivariate logistic regression models to identify predictors of treatment allocation (P vs I groups). The observed follow-up time statistics was computed directly from all observed follow-up times, including the censored cases. The association between selected variables and survival was evaluated using multivariate Cox proportional hazards models. Statistical significance was defined as $p < 0.05$. Baseline characteristics were calculated in the software Numbers version 6.1 (Apple) and statistical testing of groups differences using software Python 3.9.12 with modules scipy 1.11.1., scikit-survival 0.21.0, scikit-learn 1.2.2, statsmodels 0.13.2.

Results

3.1 Patients characteristics

A total of 69 patients were included in the analysis: 36 men (53%), 33 women (47%). Median age was 69 (range 65–77) years in Control group (C), 74 years (range 65–84 years) in Intervention group (I) and 77 (range 69–86 years) in Palliative group (P). Basic demographics characteristics are summarized in Table 1.

3.2. Overall survival

The median follow-up times were 6.5 months (range 0.9–52.6), 12.7 (range 0.9–63.5) and 16.3 (range 1.1–78.9) months for P, I and C groups respectively. Median overall survival (mOS) was 7.5 months (IQR 2.96 to 15.6 months) in palliative group, 14.3 months (IQR: 6.0 to 26.46 months) in intervention group, and 16.3 months (IQR: 8.5 to 25.6 months) in the control group. Kaplan-Meier curves of survival in groups I, P, C are in Fig. 2. Log-rank testing showed no statistical differences between groups (P vs I, HR = 1.78, 95% CI 0.97–3.27, p = 0.054; I vs C, HR = 0.85, 95%CI. 0.44–1.64, p = 0.63; P vs C, HR = 1.72, 95%CI. 0.96–3.09, p = 0.058). When the C and I groups were combined and compared with the P group,

the difference reached statistical significance: mOS C + I 16,3months (IQR: 7.3 to 26.5months) vs mOS P 7.5 months (IQR 2.96 to 15.6 months), HR = 1.78, 95% CI 1.08–2.92, p = 0.02. Kaplan-Meier curves of survival in C + I vs P groups are in Fig. 3.

3.3. Parameters associated with treatment allocation

Comparison between intervention and palliative groups demonstrated significant differences in several parameters obtained during palliative geriatric assessment (Table 1 and Fig. 4). Significant variables included:

- age-adjusted Charlson Comorbidity Index (aaCCI)
- Instrumental Activities of Daily Living (IADL)
- Karnofsky Performace Status
- EORCT QLQ-C30 Physical Functionig
- EORTC QLQ-C30 Fatigue (All $p < 0.05$).

Median aaCCI was 6 in both I and C group vs 7.5 in P group (p = 0.016), median IADL was 8 in I vs 6 in P group (p = 0,025), median Karnofsky performance status was 100% in I group vs 80% in P group (p = 0.001). We compared all functional and symptom scales and also global health status in quality of life questionnaires EORTC QLQ-C30. We found significant differences only in EORTC QLQ C30 Physical Functioning scale with higher average score in I group 82.4 vs P group 52.4 (p = 0.028), and in the Fatigue scale with lower average score in I group 30.6 vs P group 60.9 (p = 0.042).

3.4 Oncologic treatment

Adjuvant chemotherapy administration did not differ between C and I group (Fisher's exact test p = 1.00), 6 (27%) patients in I group and 6 (31%) patients in C group received adjuvant chemotherapy,16 (73%) patients in intervention group and 13 (69%) patients in control group did not receive adjuvant chemotherapy due to decline in performance status. Palliative chemotherapy was administered in 9 patients (32%) in the palliative group, 7 patients (32%) in the intervention group, and 4 patients (21%) in the control group, without statistically significant differences ($p > 0.05$).

3.5 Surgical outcomes

Length of stay in the intensive care unit did not differ significantly between surgical groups (Mann–Whitney U test p = 0.97). The rate of postoperative complications classified according to Clavien–Dindo was also comparable between groups (p = 0.40).

3.6 Multivariate analysis

Multivariate logistic regression models identified aaCCI and IADL as independent predictors of treatment allocation between intervention and palliative groups. Additional variables demonstrated collinearity and were excluded from final models. A logistic model based solely on aaCCI showed limited predictive performance when applied to the control group (classification accuracy 53%), suggesting that isolated

comorbidity assessment is insufficient without comprehensive geriatric evaluation. Cox proportional hazards modelling including IADL, aaCCI, age, and sex demonstrated that higher IADL scores were associated with reduced mortality risk, whereas higher aaCCI and female sex were associated with increased risk. Hazard ratios and confidence intervals are presented in Table 2 and Fig. 5. Age was not significantly associated with survival.

Table 1
Patients characteristics and study results. Abbreviations: CCI - Charlson Comorbidity Index, IADL - instrumental activities of daily living, ICU- intensive care unit, IQR-interquartile range, NRS-numerical rating scale, PS- performance status

Number n, (%)	**Intervention**	**Palliative**	**Control**	**Together**
	22 (32)	**28 (40)**	**19 (28)**	**69 (100)**
Age median years	74	77	69	74
(Min-Max)	(65–84)	(69–86)	(65–77)	(65–86)
Men n, (%)	10 (45)	17 (61)	9 (47)	36 (52)
Women n, (%)	12 (55)	11 (39)	10 (53)	33 (48)
median IADL	8	6	NA	**p = 0.025**
Karnofsky PS median	100	80	NA	**p = 0.001**
Pain NRS median (Min-Max)	0 (0–6)	2. 5 (0–8)	NA	p = 1
median length of stay at ICU (days)	6.0	NA	6.0	p = 0.97
Complications after surgery gr. > 3 n (%)	12 (54%)	NA	8 (42%)	p = 0.40
median Overall survival (IQR) months	14.3 (6.0 to 26.46)	7.5 (2.96 to 15.6)	16.3 (8.5 to 25.6)	P vs I, p = 0.054; I vs C, p = 0.63; P vs C, p = 0.058 **C + I vs P, p = 0.02**
adjuvant chemotherapy administartion n, (%)	6 (27%)	NA	6 (31%)	OR 0.812, p = 1.0
palliative chemotherapy administartion n, (%)	7 (32%)	9 (32%)	4 (21%)	S vs C OR 1.75, p = 0.49 P vs C OR 1.77, p = 0.515
EORTC-QLQ-C30 Physical functioning **average score**	82.4	52.4	NA	**p = 0.028**
EORTC-QLQ-C30 Fatigue **average score**	30.6	60.9	NA	**p = 0.042**

Table 2
multiple univariate analysis by Mann-Whitney U test and Welch test with Bonferonni correction to test the difference between groups P and I in several parameters. The variable is considered significant if p_bonferroni < 0.05. numerical values of the CPH parameters. exp(coef) = HR. aaCCI - age adjusted Charlson Comorbidity Index, IADL - instrumental activities of daily living.

IADL	coef	exp(coef)	se(coef)	coef lower 95%	coef upper 95%	exp(coef) lower 95%	exp(coef) upper 95%
	-0.27	**0.77**	**0.07**	**-0.41**	**-0.12**	**0.66**	**0.89**
Age	-0.01	0.99	0.03	-0.07	0.05	0.93	1.06
Sex	0.70	2.02	0.34	0.03	1.38	1.03	3.97
aaCCI	0.28	1.33	0.13	0.03	0.54	1.03	1.71

Discussion

The present study evaluated the role of comprehensive palliative geriatric assessment in shared decision-making for older patients with resectable pancreatic ductal adenocarcinoma. Our findings suggest that structured collaboration between pancreatic surgeons and palliative care specialists may improve identification of geriatric patients who are suitable candidates for pancreatic surgery without worsening postoperative outcomes.

Pancreatic resection followed by adjuvant chemotherapy remains the only potentially curative treatment for pancreatic adenocarcinoma; however, treatment decisions in older patients are challenging due to frailty, multimorbidity, and risk of functional decline [7, 8, 9]. Chronological age alone is insufficient for surgical selection, and inappropriate patient selection may lead to postoperative deterioration without meaningful survival benefit, while carefully selected older patients may achieve surgical outcomes comparable to younger patients [12, 13], especially when ERAS (Enhanced Recovery After Surgery) recommendations are followed [14].

Shared decision-making represents an essential component of contemporary person-centered oncology care [15]. It is a time-consuming process requiring communication skills that extend beyond usual surgical training and time constraints [16]. Palliative care specialists, trained in communication and goal-of-care discussions, may contribute substantially to this process by integrating medical risk assessment with patients' values, expectations, and functional status [15]. Patients and their families are ensured that their values and preferences truly matter and that the treatment plan is concordant with their goals of care. A shared decision-making process led by a palliative care specialist ensures that patients are not left to face difficult choices alone and will not be abandoned by clinicians if they decide not to proceed with surgery or other anticancer treatment [15].

Our model of early palliative involvement allowed individualized treatment decisions while maintaining comparable surgical morbidity and intensive care unit utilization between surgically treated groups, as

reflected by comparable Clavien–Dindo complication rates (p = 0.40) and intensive care unit length of stay (p = 0.97). Although median overall survival did not differ significantly among study groups due to low number of subjects (P vs I p = 0.054; I vs C p = 0.63; P vs C p = 0.058), the significantly longer survival observed in surgically treated patients — 16.3 months in the combined intervention and control group compared to 7.5 months in the palliative group (C + I vs P p = 0.02) — suggests a potential benefit of careful patient selection. Importantly, only a minority of operated patients received adjuvant chemotherapy: 27% in the intervention group and 31% in the control group, with no statistically significant difference between them (p = 1.00). This highlights a clinical dilemma frequently encountered in geriatric pancreatic oncology — technical resectability does not necessarily translate into treatment tolerance [17]. The majority of operated patients did not receive adjuvant chemotherapy due to decline in performance status and increased geriatric frailty. The risk of adverse events following chemotherapy administration in geriatric patients can be estimated using the CRASH (Chemotherapy Risk Assessment Scale for High-Age Patients) score [18].

Among the evaluated parameters, age-adjusted Charlson Comorbidity Index (aaCCI) and Instrumental Activities of Daily Living (IADL) emerged as independent predictors of treatment allocation between the intervention and palliative groups in multivariate logistic regression analysis. Patients with lower comorbidity burden — median aaCCI 6 in the intervention group versus 7.5 in the palliative group (p = 0.016) — and preserved functional independence — median IADL 8 versus 6 (p = 0.025) — were more likely to be selected for surgery and demonstrated improved survival outcomes. Notably, chronological age was not significantly associated with survival in Cox proportional hazards modelling, further supporting the principle that functional status rather than age should guide treatment decisions in this population. A logistic model based solely on aaCCI showed limited predictive accuracy when applied to the control group (53%), underscoring that isolated comorbidity assessment is insufficient without comprehensive geriatric evaluation. Quality-of-life domains, specifically EORTC QLQ-C30 Physical Functioning (82.4 vs 52.4, p = 0.028) and Fatigue (30.6 vs 60.9, p = 0.042), significantly differed between the intervention and palliative groups and were associated with treatment allocation; however, they did not independently predict survival in multivariate analysis. The EORTC QLQ-C30 nonetheless represents an important validated tool for patient self-assessment and, in other studies, has provided independent prognostic information with potential implications for patient stratification in clinical trials [19, 20].

Our comprehensive palliative geriatric assessment identified 22 patients (32%) initially considered frail or borderline by surgeons who subsequently underwent surgery with postoperative outcomes — including complication rates and intensive care utilization — comparable to the 19 patients selected directly for surgical treatment in the control group. These findings suggest that structured palliative geriatric evaluation may prevent both undertreatment and overtreatment in older patients with resectable pancreatic cancer. Simple and reproducible tools such as IADL and aaCCI appear practical for routine clinical use and may effectively support shared decision-making in a busy surgical practice.

This study has several limitations. These include a relatively small sample size, single-center design, retrospective data collection, absence of randomization, and incomplete functional and quality-of-life

data in the control group. External validation in larger prospective cohorts is therefore required.

Conclusion

Comprehensive palliative geriatric assessment supports shared decision-making in older patients with resectable pancreatic ductal adenocarcinoma and can identify surgical candidates who might otherwise be excluded based on initial clinical impression alone. Among the parameters assessed, IADL and aaCCI were the most useful independent predictors of treatment allocation; however, a single-parameter model based on aaCCI alone was insufficient to capture the full complexity of geriatric evaluation, highlighting the need for a multidimensional approach.

Differences in physical functioning and fatigue scores between the intervention and palliative groups reflect the clinical relevance of functional assessment in treatment planning and are consistent with evidence supporting early integration of palliative care in pancreatic cancer management. When surgery is not indicated, simultaneous planning of oncological and palliative treatment — addressing symptoms, prognosis, and individual patient priorities — is essential to ensure continuity and quality of care. Equally, surgical candidates benefit from optimal pre- and postoperative preparation within centers capable of providing integrated oncological and palliative expertise.

Early integration of palliative geriatric assessment into the preoperative pathway represents a feasible and potentially beneficial strategy to optimize treatment selection in older patients with resectable pancreatic cancer. Future prospective studies with larger patient cohorts should aim to validate standardized multidisciplinary algorithms that combine surgical evaluation with geriatric and palliative care expertise, with the goal of improving both treatment appropriateness and patient-centered outcomes.

Statements and Declarations

The authors have no relevant financial or non-financial interest to disclose that are relevant to the content of this article. This research did not received any funding.

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Bioethics Committee of the National Cancer Institute in Bratislava, Slovakia.

Author Contribution

LD, AS designed the study. LD collected the data. JS statistically analysed the data. LD, JS wrote the main manuscript text, JS prepared statistics and Figures 2-5, LD prepared Fig 1. MM and KG contributed

to study supervision and criticall revision of the manuscript. All authors reviewed and approved the final version of the manuscript.

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Data Availability

All data supporting the findings of this study are available within the paper and its Supplementary Information.

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Figures

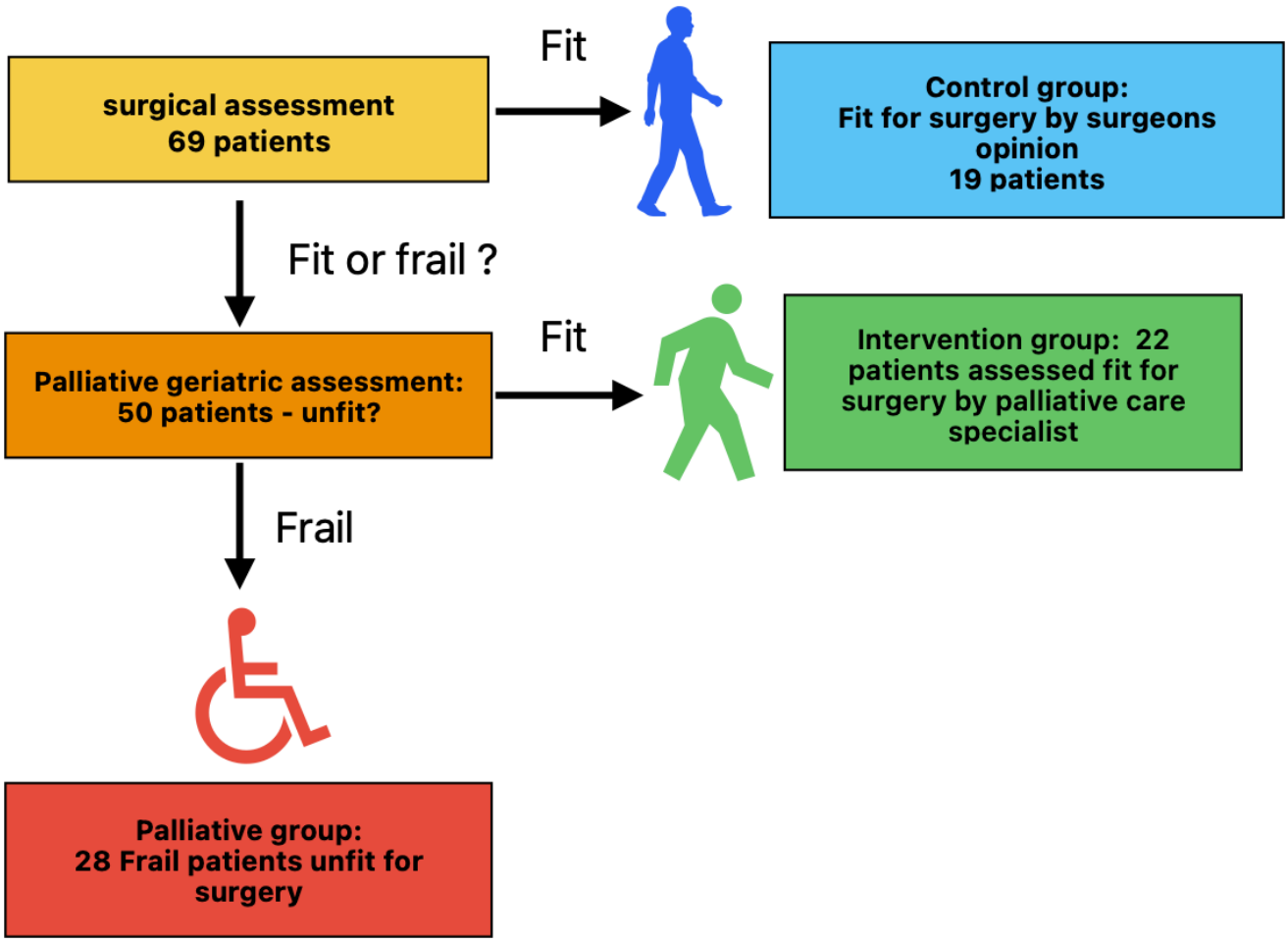


Figure 1

Study design

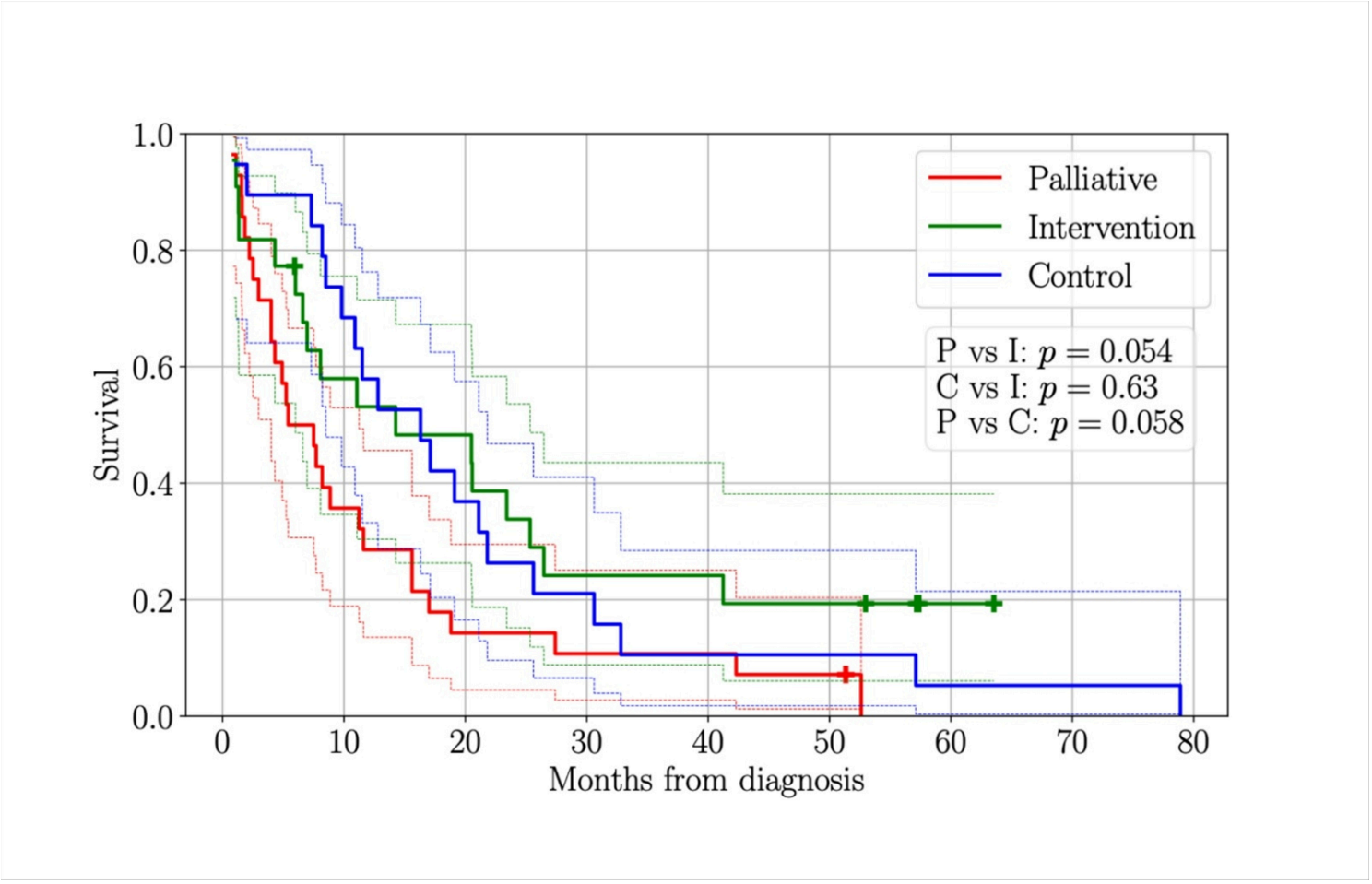


Figure 2

Kaplan-Maier curves of survival: mOS in palliative group was 7.5 months, mOS in intervention group was 14.3 months, mOS in Control group was 16.3 months, P vs I, p=0.054; I vs C, p=0.63; P vs C, p=0.058). Confidence interval of 95% is marked as dotted lines.

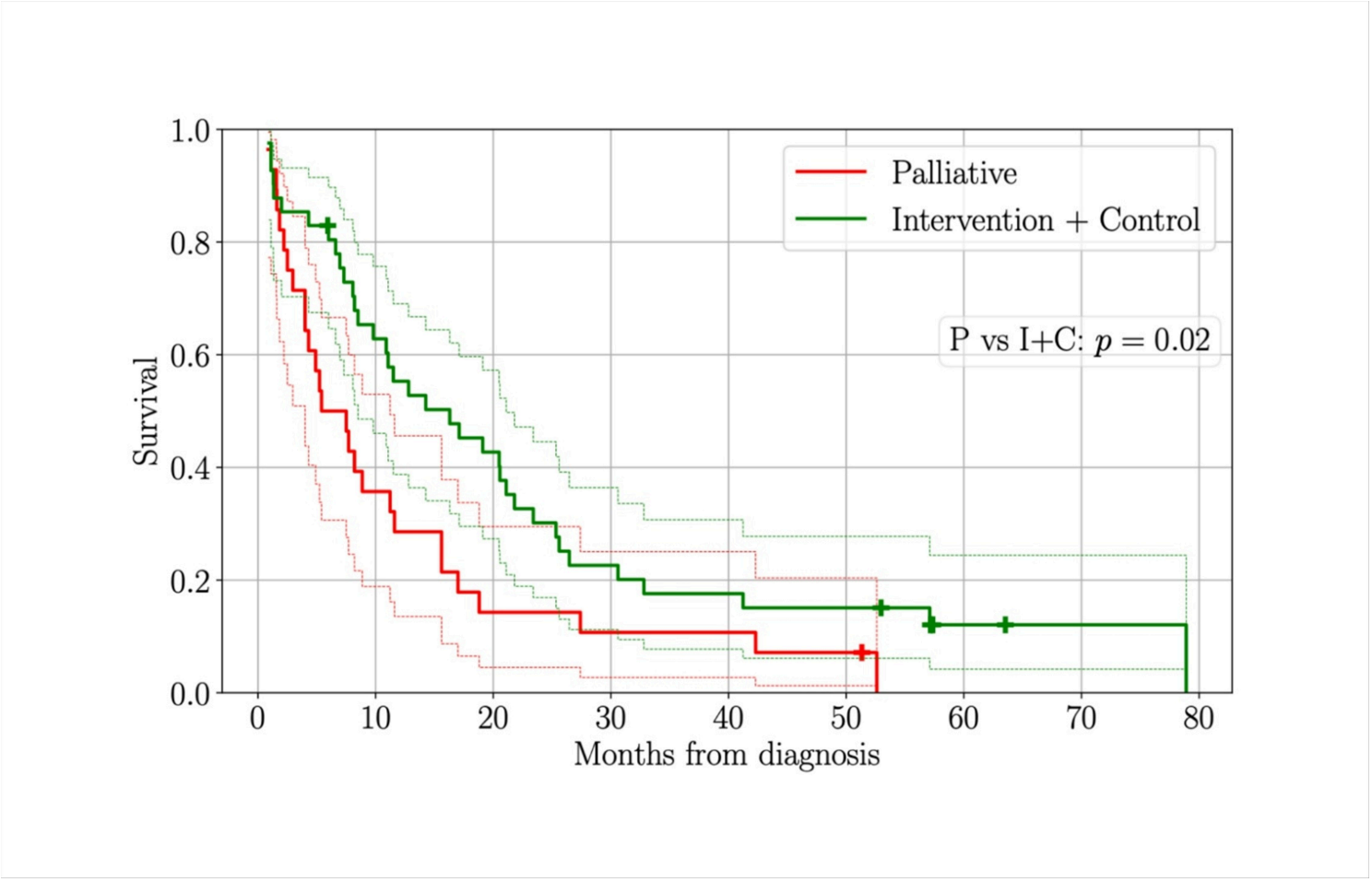


Figure 3

Kaplan-Maier curves of survival C+I vs P: mOS in combined C+I 16.3 months vs P mOS 7.5 months, HR = 1.78, 95% CI 1.08–2.92, p = 0.02. Confidence interval of 95% is marked as dotted lines.

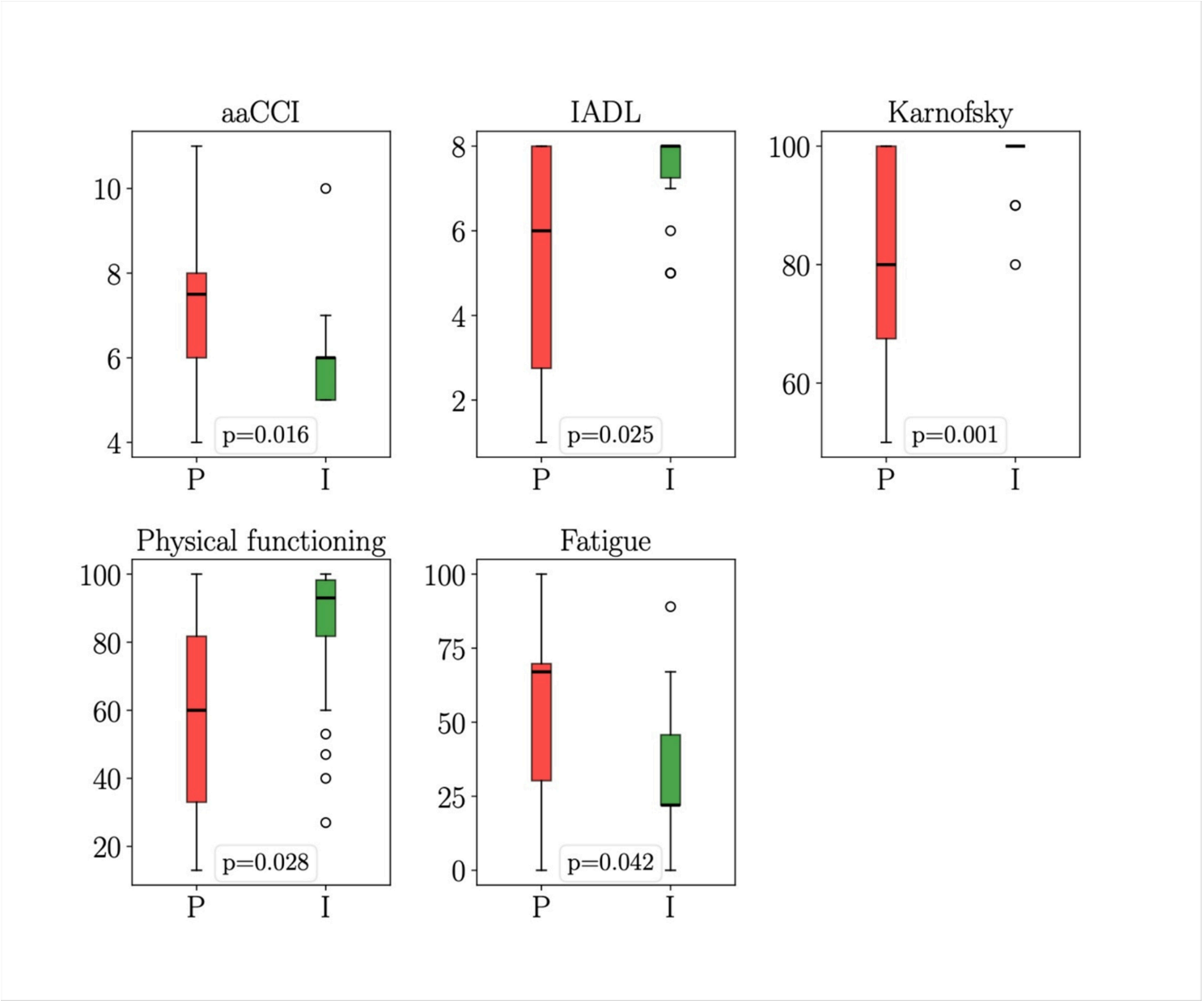


Figure 4

Boxplots of variables that differ significantly in (Mann-Whitney U test, p values shown) between the palliative (P) and the Intervention (I) groups.

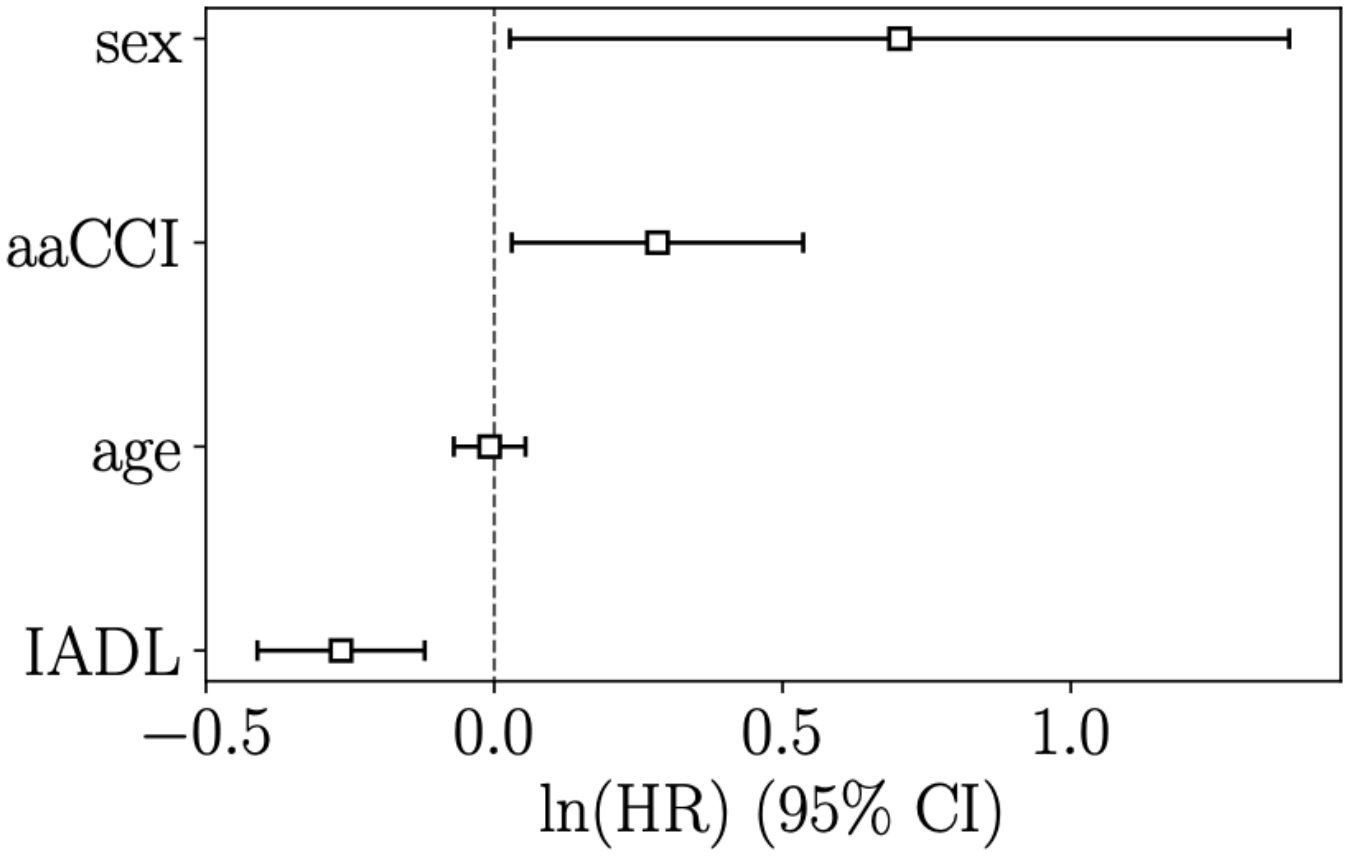


Figure 5

CPH model. Logarithms of hazard ratio (HR) shown including 95% confidence intervals (CI). aaCCI - age adjusted Charlson Comorbidity Index, IADL - instrumental activities of daily living.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Supplement1.xlsx