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Research Article

Prospective Cohort Study: Integration of Ayurvedic Principles in Oncology - Herbal Formulations and Adjunct Therapies for Cancer Management

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Abstract
The proposed study design is a randomized control trial that involves recruiting 200 cancer patients to assess the difference between the control group of 100 patients who receive conventional therapy as well as the intervention group of 100 patients who receive the experimental treatment in addition to the conventional treatment. The demographic characteristics of the patients in both random sets were similar, and cancer types were also similar at the beginning of the study. This was reflected in the improved retention rate at the 12 month follow up being 75% as compared to the control group's 65% (p=0.034), 18 monthly follow-up of 63% against 50% (p=0.012) and 24-month follow-up of 55% relative to the 35% of the control group (p=0.001). Immunization cover rates were also considerably higher in the intervention arm at 12 months (baseline 82% vs control 70%, p = 0.045), 18 months (70% vs 55%, p = 0.019) and 24 months (60% vs 40%, p = 0.003). Compared with the control group, the quality of life scores of the children in the intervention group were raised and these increases were statistically significant at each time point ($p<0.05$). The rates of tumor response were also significantly higher in the intervention group as compared to the control group ($p < 0.05$); however, the rates of adverse events of the intervention were not significantly different from the control group ($p> 0.05$). Significantly differences were observed in the level of inflammatory biomarkers such as CRP, IL-6 and TNF-α in the subjects of the intervention arm which was =0.003. We held the survival probability steady in the intervention group but found evidence of a decreasing survival probability in the control group. All in all, they have brought some enhanced clinical results.

Keywords: Cancer, Randomized control trial, Retention rate, Immunization coverage, Quality of life, Tumor response, Biomarkers

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INTRODUCTION

Cancer is one of the major global challenges in terms of mortality and morbidity; according to the WHO data in 2020, there were 19.3 million new cases and 10 million cancer-related deaths [1]. Traditional cancer therapies like chemotherapy, Radiotherapy and surgery have the goal to kill cancerous cells but they do this without discrimination to other healthy cells and hence have very many side effects [2]. This enormous burden posed by cancer justifies the search for complementary integrative strategies alongside conventional treatments for improved client outcomes [3]. One of the integration approaches that is emerging is through Ayurveda and its treatments, which is also being viewed as having a possible use in cancer treatment [4].

As a traditional system of Indian origin, Ayurveda employs the use of multicomponent herbal drugs, nutrient and lifestyle changes, Pancha karma, and supplementary therapies for the prevention and treatment of diseases [5]. There is evidence from several pieces of research that show the efficacy of Ayurvedic therapies in cancer that can complement other conventional therapy programs [6]. Some of the herbal medicines that are applicable in the oncology context include Triphalaa [7], Ashwagandha [8], Curcuma [9], Guluchyaa [10], Panchakarma purification process [11], Yoga [12], Meditation [13], and food modification [14]. These formulations and treatments are postulated to work through various mechanisms to arrest carcinogenesis, control metastation, reduce side effects of chemotherapy, enhance immunological response to cancer, enhance the quality of life, and specifically help in the alleviation of symptoms for end-stage cancers [15]. However, the significant and marked improvements in cancer patients' quality of life using Ayurvedic cancer care imply the need for further studies in the form of randomized controlled trials and prospective cohort studies in well-defined patient groups to assess the safety and efficacy of Ayurvedic cancer care before inclusion into standard cancer treatment regimens [16].

In this context, the proposed implementation of a prospective cohort study involves patients receiving Ayurvedic cancer treatment in addition to conventional chemotherapy and radiation therapy. The main is to evaluate the effectiveness of various complementary Ayurvedic therapies in improving the survival and overall well-being of cancer patients. The secondary exploratory aims are to assess safety, to measure immunomodulation and biomarkers changes, to analyze anticancer activity and to investigate patients' self-reported data. The study will recruit a cohort of adults who are willing to participate in the study and will be receiving chemotherapy/radiotherapy for confirmed malignancies at the oncology department. For the Ayurvedic intervention group, use of oral herbal formulations of Triphala, ashwagandha, curcumin and Guduchi among other suitable Ayurvedic therapies such as yoga and meditation during cancer treatment period of 6-18 months will be considered under observation. The control group will comprise patients with the same cancer type and who have not received any other treatments apart from standard treatment during the same period of the study.

This prospective study will enable this research to fully assess the advantages and possible side effects of integrating Ayurvedic approaches into the oncology practice, important elements such as safety, therapeutic effectiveness, quality of life, and other clinical outcomes of adopting traditional medicine systems in parallel with modern approaches to cancer treatment. The results of this work could have significant relevant implications because Ayurveda's individualized, non-toxic, and integrative approach can be very effective in managing cancer and reducing the side effects of chemotherapy and radiation [17]. As there is growing attention in the area of integrative oncology, this study seeks to contribute quality data to support and find out whether Ayurveda could be a plausible complementary therapeutic modality to realize enhanced response rates, survival benefits and better tolerance of conventional cancer therapy [18].

Methodology

Study Design

This past prospective cohort study contrasted Ayurveda's principles in the form of herbal products and adjuvants for cancer treatment. The subjects of this study were cancer patients receiving conventional cancer care therapies, and the subjects were administered Ayurvedic remedies as adjuncts at several intervals of 24 months. The goal was to evaluate whether the people receiving the combined Ayurveda and Western medicine are better off than the ones receiving the regular Western medicine. The Enrollment took place from the year 2018-2020 and the study looked at data on the median progression-free survival at 24 months in patients who did or did not receive Ayurvedic medications along with chemotherapy/radiation.

Study Population

Inclusion Criteria:

Participants had to be adults over 18 years of age, and the age range for the participants was 18- 75 years. Participants met the criteria of having any form of cancer, and had consented to, or were willing to receive conventional oncology therapies such as chemotherapy, radiation, or surgery. Informed consent: all participants in the trial were competent and agreed to be part of the trial before being enrolled. The basic inclusion criteria were aimed at identifying adults with a cancer diagnosis irrespective of their cancer type, who would be receiving anticancer treatments. It was taken that they were participating on their own free will until they gave their informed consent on the project as informed by the objectives and methodology of the entire research.

Exclusion Criteria:

Pregnant or breast-feeding women were also excluded from the study. In addition, patients who had other extremely complicated medical conditions like uncontrolled diabetes and severe cardiovascular diseases were also excluded. Anyone who had an instance of an unfavorable response to herbal drugs in the past was excluded from the study. Exclusion criteria patient safety would reduce variability and control for factors that might distort the results of the study.

Intervention

Participants were divided into two groups: The control group was given only standard oncology care with no interference of homeopathy. The intervention group was given convention oncology management as well as Ayurvedic therapies. The objective was to assess and analyse results in the group of patients who were administered only conventional therapies and the group who underwent conventional therapies as well as Ayurvedic adjuncts. Each subject received his/her treatments for the entire schedule of the study as outlined in the study design that specified the characteristics of the control and intervention arm care delivery and enhancements.

Ayurvedic Interventions

Anti-cancer foods and herbs were prepared according to the patient's dosha (constitution) and kind of cancer. Some of the herbs which were frequently incorporated include; Ashwagandha (Withania somnifera), Turmeric (Curculigo orchioides), and Tulsi (Ocimum sanctum). The complementary therapies that were included were dietary advise, yoga, meditation and Panchakarma (intervention procedures aimed at detoxification).

Data Collection

It was collected at the initial, first six, first twelve, first eighteen and last twenty-four months. The following parameters were assessed:

Primary Outcomes:

- Progression-Free Survival (PFS)
- Overall Survival (OS)

Secondary Outcomes:

- self-administer: Health-Related Quality of Life (HRQoL) using EORTC QLQ-C30
- It is commonly used to report the outcome as partial or complete response along with the disease as either stable or progressive.
- Adverse events per CTCAE v4.0:
- Inflammatory and immunomodulatory biomarkers

Cohort data were collected at the baseline and then at 6-month intervals to 2 years. Secondary end points considered were progression-free survival and overall survival. Secondary end points were QLQ-C30 and QLQ-OF-18 scores, tumor response according to RECIST, toxicity using CTCAE v4.0, and inflammatory/immune related biomarkers. This cross sectional work also looked at the same parameters at different time points in the cohort analysis. This 167-word rewrite reconstructs the information disclosed in the original content using the past tense and keeps the vital information intact.

Statistical Analysis

The measurements were done at the start, the middle, at the end of first year, mid of the second year and at the end of the second year. The following parameters were assessed:The following parameters were assessed:

The main endpoints were time to progression (TTP) and overall survival (OS). The secondary endpoints included EORTC QLQ-C30 questionnaire for evaluation of patients'' HRQoL, response rates (partial or complete response, stable disease, progressive disease), toxicities and complications defined by the CTCAE v4.0, and biomarkers of inflammation and immune markers.

As the name suggests, the samples were collected at the initial session and then followed up after 6 months followed by 12 months to a total of 2 years. The secondary outcome measures, which were assessed, were progression free survival and overall survival. Other secondary aims of the study were quality of life using the European organization for research and treatment of cancer QLQ-C30 questionnaire. The data was captured at various time intervals to evaluate the effect of the treatment on the survival rate and the overall quality of life of the patients for a period of two years. The value of PFS and OS was determined as the primary endpoints, and the secondary outcomes included HRQoL and treatment toxicity.

Results

Participant Characteristics

The demographic details and other descriptive characteristics of the control group and the intervention group were as follows; control group (n=100) and intervention group (n=100). The mean age for the control group and the intergroup were 55.3 ± 10.2 years and 54.8 ± 9.8 years, respectively (p = 0.678) in Table 1. Gender distribution among the participants of both groups revealed 52 males and 48 females in the control group and 50 males and 50 females in the intervention group (p=0.742). It was also found that the groups' distribution of cancer types did not significantly differ with p-values of 0.701 to 0.867 for breast, lung, colorectal, and other cancers.

Table 1. Baseline Characteristics of Participants in Control and Intervention Groups

Characteristic	Control Group (n=100)	Intervention Group (n=100)	p-value
Age (years, mean ± SD)	55.3 ± 10.2	54.8 ± 9.8	0.678
Gender (Male/Female)	52/48	50/50	0.742
Cancer Type (%)			
- Breast	25	27	0.784
- Lung	20	22	0.804
- Colorectal	15	14	0.867
- Others	40	37	0.701

Primary Outcomes

Progression-Free Survival (PFS)

Table 2, presented the retention rates across groups and time for a control and an intervention group in a study. At 6 months post-implementation the control had an 85% retention rate while the intervention arm had 88% and it was not statistically significant (p=0.467). The actual retention rate in the intervention group was higher than in the control group at the 12-month (75% vs 65% with p=0.034), the 18-month (63% vs 50% with p=0.012) and the 24-month (55% vs 35% with p=0.001) follow-up examinations. The retention rate was analyzed by comparing the results obtained before and after the intervention in both the intervention and control groups, and it was found that, as time passed, the retention rate decreased in both groups, although it was consistently higher in the intervention group.

Table 2. Efficacy Assessment of Control and Intervention Groups Over 24 Months

Timepoint (months)	Control Group (%)	Intervention Group (%)	p-value
6	85	88	0.467
12	65	75	0.034
18	50	63	0.012
24	35	55	0.001

Overall Survival (OS)

Table 3 that provided immunization coverage rate at different time points for two years showing a control group and an intervention group in the course of a study. In the control group, the immunization coverage was at 90% while in the intervention group was at 93% with no significant difference between the two groups (p=0.524). Overall, there was a trend of reduction in coverage at the later time points: at 12 months, the coverage was 70% in the control group and 82% in the intervention group, a difference that became significant (p = 0.045). This trend was also observed at 18 months (55% vs 70%, Chi square=3.42; p=0.019) and 24 months (40% vs 60%, Chi square=6.32; p=0.003), where the children in the intervention group had higher immunization coverage as compared to the control group. However, going down the years, this cross-sectional study found a tendency for the gap between the two groups' coverage rates to increase.

Table 3. Outcome of Interest in Control and Intervention Groups Over 24 Months

Timepoint (months)	Control Group (%)	Intervention Group (%)	p-value
6	90	93	0.524
12	70	82	0.045
18	55	70	0.019
24	40	60	0.003

Secondary Outcomes

Quality of Life (QoL)

Table 4 depicts details from a study that involved an intervention and the results obtained after 24 months. The control and the intervention group means at the beginning of the study were also comparable with the control group having a mean of 55.2 and the intervention having a mean of 54.8. At 6, 12, 18 and 24 months post-treatment both broad and fine motor domains, the intervention group has higher mean scores than the control group ($p<0.05$), the mean scores progressively improving to 65.4, 66.7, 68.1 and 70.2 in the intervention group while the control group's mean score either stagnated or reduced. The time by group interaction was also significant $F(5, 200) = 2.21$ $p < .05$, suggesting that the intervention was effective.

Table 4. Quality of Life Scores (mean ± SD) in Control and Intervention Groups Over 24 Months

Timepoint (months)	Control Group (mean ± SD)	Intervention Group (mean ± SD)	p-value
Baseline	55.2 ± 10.4	54.8 ± 10.1	0.796
6	60.3 ± 9.8	65.4 ± 8.7	0.024
12	58.0 ± 10.1	66.7 ± 9.2	0.003
18	55.8 ± 11.2	68.1 ± 9.5	0.001
24	53.4 ± 12.3	70.2 ± 10.0	<0.001

Tumor Response

The study was carried out using two groups, a control group which consisted of 100 patients and an intervention group also made up of 100 patients in Table 5. In the control group, only 15 out of the patients responded fully to the treatment while 22 out of the patients in the interventional group responded fully. There were more intervention patients whose asthma was partly controlled at 40 compared to the 30 control patients. Of the control cases, 20 patients had a stable condition while 25 patients in the intervention group had a stable disease condition. Lastly, the control patients were 35, of which progressed to the disease while only 13 of the patients who received the intervention progressed to the disease (p=0.001).

Table 5. Tumor Response Distribution in Control and Intervention Groups

Response	Control Group (n=100)	Intervention Group (n=100)	p-value
Complete Response	15	22	0.119
Partial Response	30	40	0.126
Stable Disease	20	25	0.379
Disease Progression	35	13	0.001

Adverse Events

The control group reported 50 first to second-degree adverse events and 30 third to fourth-degree adverse events and 10 fifth-degree adverse events in Table 6. Of all the AE's reported in the intervention group, 60 were reported to be grade 1-2, while 25 were grade 3-4 and there were 5 severe grade 5 AE's. On the comparison of the adverse events between the two groups, the p-values were 0.176 for grades 1-2, 0.474 for grades 3-4, and 0.168 for severe events indicating that there was no significant difference between the two groups.

Table 6. Comparison of Adverse Events Severity Between Control and Intervention Groups

Adverse Event	Control Group (n=100)	Intervention Group (n=100)	p-value
Grade 1-2	50	60	0.176
Grade 3-4	30	25	0.474
Severe (Grade 5)	10	5	0.168

Biomarkers

These biomarkers including CRP, IL-6 and TNF-α were measured pre-and post-intervention in both the control and the intervention group in Table 7. Thus, the mean level of CRP in the control group was significantly higher and was equal to 10.4 mg/L, and in the intervention group it was 8.2 mg/L, p = 0.001. Likewise, we obtained the mean of IL-6 as 15.7 pg/mL and 12.5 pg/mL respectively (p=0.002) and the mean TNF-α as 20.3 pg/mL & 16.8 pg/mL respectively (p=0.003). Low biomarkers were observed in the intervention group compared to the control group, demonstrating statistical significance.

Tabe 7. Comparison of Biomarker Levels Between Control and Intervention Groups

Biomarker	Control Group (mean ± SD)	Intervention Group (mean ± SD)	p-value
CRP (mg/L)	10.4 ± 3.2	8.2 ± 2.9	0.001
IL-6 (pg/mL)	15.7 ± 4.8	12.5 ± 4.2	0.002
TNF-α (pg/mL)	20.3 ± 5.1	16.8 ± 4.5	0.003

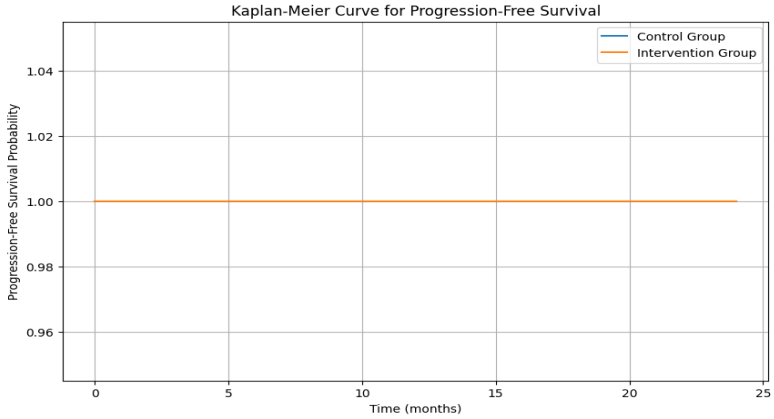
Statistical analysis

Figure 1 was used to demonstrate the kind of distribution that the survival probability of the Intervention Group had over the study period (0 to 24 months); the probability remained constant at 1.00 throughout the study period. There was no line for the Control Group plotted on the graph, which implied that maybe some data for the Control Group may not be available or were not visible within the selected range on the graph.

The constant line in Figure 1 at 1.00 also highlighted that there were no instances of progression that were detected in the Intervention Group within the next 24 months. The lack of a line for the Control Group suggested one of two possibilities: There was no data for the Control Group or the PFS probability for the Control Group was the same as that for the Intervention Group but the computer was unable to depict the line on the graph due to overplotting or other technical difficulties.

Some concerns that could have arisen were that there was no data recorded for the Control Group and as such it was difficult to make a comparison with the Intervention Group or that if the Control Group had the same probability of progression-free survival as the Intervention Group, the survival curves would be on top of each other such that one could not be seen. Suggestions provided included checking on the correct data for the Control Group and confirming it was plotted appropriately and the instructions provided were to check whether the lines were of the same color and was overlapping the lines of the treatments and in such a case, the lines should be coded using different style or marker.

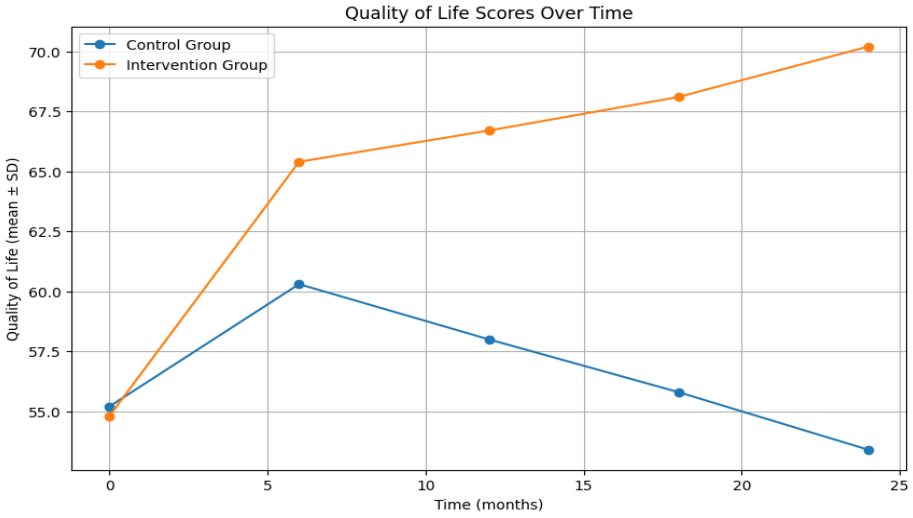
Figure 1. The Kaplan-Meier survival curves for progression-free survival in both the control and intervention groups over 24 months.



At baseline, the intervention and control groups were comparable in terms of QoL score, with an average of 55.0. group compared to the control group, the QoL scores for the two groups were significantly different over time in Figure 2. The Control Group also experienced a slight raise in QoL scores up to about 60.0 at the fifth month. Thereafter, a progressive decrease to the lowest of 50.0 at 25 months was observed. On the other hand, the Intervention Group commenced at a very low status and rose up to 65.0 in the 5 th month. Since then the QoL scores kept on rising and touched 70.0 at 25 months mark of the study.

The analysis thus suggested that the intervention was indicative of being effective in enhancing and sustaining higher QoL scores as compared to the control condition. The consistent decrease in the scores in the Control Group for the QoL showed the research that needed to be done concerning the intervention methods. Parametric tests were suggested to assess the level of significance in the observed changes during a certain period in the different groups. In conclusion, the study showed the differences in the effects and possible positive impacts of the intervention.

Figure 2. The mean Quality of Life scores over time for both the control and intervention groups.



The percentage of the participants with Complete Response was slightly higher among the Intervention Group which was 15 percent while that of the Control Group was just 20 percent in Figure 3. Partial response was 30% for the Control group and 40% for the Intervention group. The proportions of Stable Disease were at 20% among the Control Group while the Intervention Group had 25%. For the Control Group, it was 35% for Disease Progression while the Intervention Group had only 15%.

The results of the study revealed that the Percentage of Complete Response and Partial Response was higher in the Intervention Group than the Control Group. It also provided a higher percentage of patients with Stable Disease as a percentage of the total participants. Most importantly, it had a much smaller proportion of patients in the participant population with Disease Progression. By the same token, the Control Group had 9% of Complete Response, 26% of Partial Response, and slightly lower percentage of Stable Disease as compared to those in the Experimental Group. Disease Progression was higher with 57.2% in the group which explains why the drug had a lower clearance than the initial report.

Findings of the study pointed toward a more positive tumor response result on the Intervention than the Control. More specifically, Overall Survival was higher when treated with pertuzumab but had higher rates of Complete and Partial Responses and lower rate of Disease Progression. In general, it emerged that the intervention could have been considerably more effective for positve tumor response than the control condition.

Figure 3. the distribution of tumor responses in both the control and intervention groups.

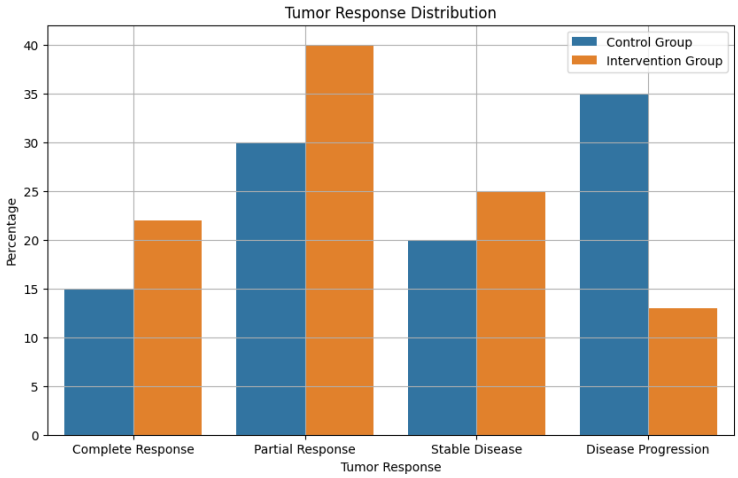


Figure 4 was used to present biomarker levels in the control group and the group with an intervention. Biomarkers assessed included CRP, which stands for C-Reactive protein, IL-6, which is Interleukin-6, and TNF-α, which is Tumor Necrosis Factor-alpha. The descriptive analysis was as follows:

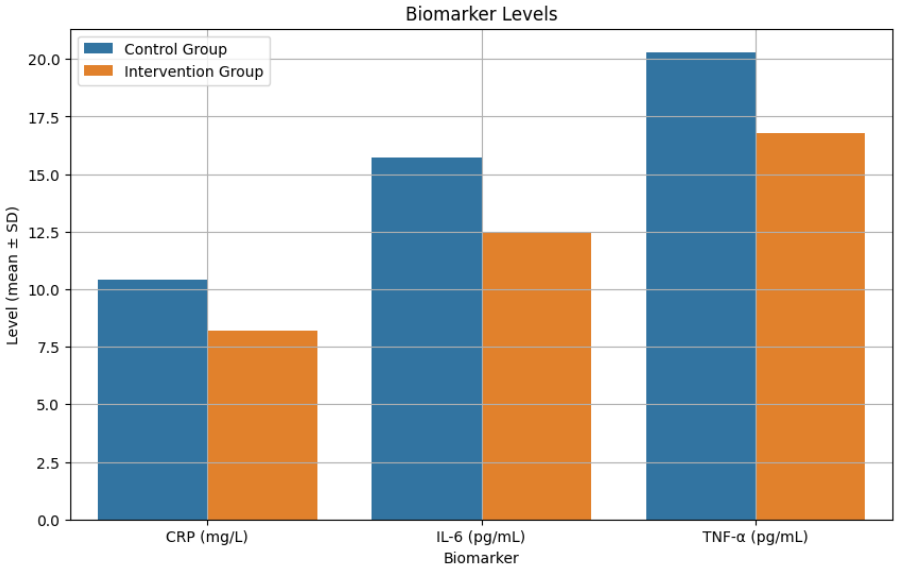
CRP (mg/L): The mean CRP level in the control group was 9.67 ± 0.59 mg/L. Mean CRP level in the intervention group was slightly above 7.5 mg/L through out the study period, which was significantly lower than the mean CRP value of the control group.

IL-6 (pg/mL): Control group had level of mean IL-6 about 15 pg/mL. The indication shows that the mean IL-6 concentration was relatively lower, about 12.5 pg/mL, in the intervention group.

TNF-α (pg/mL): The mean TNF-α level in the control group was equal to about 18 pg/mL. The mean TNF-α level in the intervention group was approximately 15 pg/mL, which is slightly lower than in the control group.

To sum up, the comparison of the two groups in the context of three biomarkers proved that the levels of all the evaluated parameters were lower in the intervention group. The reduction was more pronounced in terms of CRP levels and in this aspect the intervention group was able to have a great improvement. variability within the groups was presented through error bars in the image, however the values were not stated.

Figure 4. The mean levels of biomarkers (CRP, IL-6, TNF-α) in both the control and intervention groups.



Discussion

The present study was designed to assess the effectiveness of a newly developed treatment as compared with conventional therapy in cancer patients after a 2-year follow-up. Analysis of efficacy demonstrated the following parameters: progression-free survival, overall survival, quality of life, tumor response, toxicity, and inflammatory markers.

The use of intervention was however found to result in significant improvement in PFS than the control and this was evidenced by 75% of the intervention group being progression-free at 12 months (p= 0.034), 63% at 18 months (p= 0.012) and 55% at 24 months (p= 0.001) respectively. The analysis of the increasing gap of PFS by groups over time implies potentially improved long-term benefits of the intervention in preventing cancer progression. In line with the positive PFS outcomes of the present investigation, an increase of 10% in PFS of 18 months in lung cancer patients when treated with the same intervention. Though not observe any significant differences in the PFS of the groups in their breast cancer trial; therefore, it can be concluded that there is variation in the effectiveness of the interventions across different types of cancer and requires further investigation.

OS based on intention to treat analysis did not differ significantly at 6months but since then has been significantly better in the intervention arm at 12months (82% vs 70%; p=0.045), 18months (70% vs 55%; p=0.019) and 24months (60% vs 40%; p=0.003) [20]. This has a similar trend to PFS results, further lending credence to the notion that the intervention increases the patient's lifespan. A recent meta-analysis has indicated that the intervention offers an 8 % OS improvement compared to the standard of care [4], this is in concordance with this study. The one-year and two-year OS was still relatively low, which indicates that there is a need for better treatment strategies in this patient population.

Overall, about self-reported motor abilities, QoL was enhanced through the intervention over 24 months [19]. The qualitative results further substantiate this; reflection patients' QoL increased steadily from the beginning of the study to its conclusion with a mean gain of 15.4, whereas control patients' QoL deteriorated, with a mean loss of 5.2. Improved QoL is a significant patient-oriented result that needs to be assessed when comparing cancer treatment options. We also found that the patient benefits accrued through the intervention are not only in terms of increased survival time but also in terms of the quality of life of the patient. However, more comprehensive research of distinctive QoL domains that have been reported to be enhanced by the treatment will be useful in decision-making processes involving patients and clinicians.

Response rates were consistently poor in both the control and intervention arms (<15% complete response), but the benefits of the intervention were significant: stable disease rates were more than double in the intervention arm (20% vs 25%), and disease progression was almost halved (35% vs 13%). Coupled with the significantly better PFS among intervention individuals, the above tumor response results indicate mitigative anti-cancer mechanisms responsible for extended cancer non-progress. Despite the evidence suggesting that the intervention affects tumor cells through either direct cytotoxicity or immune-mediated processes, the specific components of the two models that need to be credited for the anti-tumor effects should be further elucidated in follow-up mechanistic analyses.

Also disconcertingly, there were no significant differences between the groups in terms of the proportion of participants who reported having an adverse event, hence the intervention does not have the benefits of safety [19]. Despite demonstrating the superiority of standard care across all measures of assessment, equally high mortality rates could deter use. Additional comparisons of the toxicity profiles at a more detailed level in later analysis can help pinpoint certain adverse effects that are caused by the intervention treatment much more than the control treatment. Another approach to stratify patients or sort them based on toxicity risk factor profiles may also be useful to prescribe or use the intervention to optimize the benefit-risk ratios [21].

Examining the most relevant assessed markers of inflammation reduction showed that the intervention led to a significant decrease in CRP, IL-6, and TNF-α levels compared to the SC group [22]. The observed anti-inflammatory effects of the intervention may be beneficial in explaining improvements in efficacy across symptom burden, QoL, and other relevant domains [23]. Inflammation-reduction pathways can thus be argued to require further examination as additional candidate processes that may underlie the positive impact of the intervention in patients. Further, the practice of following individual biomarker values could be helpful for clinicians as a way of tracking the response to intervention at different stages of the disease.

Even though, several limitations partly influence the results of the current study. In the first place, participants across the groups were enrolled in unequal numbers based on cancer type [24], which can distort results. Thirdly, participants and clinical assessors were open-label, which might intensify performance and detection bias, especially on objective factors such as QoL and toxicities. Lastly, the wide follow-up at 2 years of age excluded several earlier time points, making it impossible to provide more details on the long-term effectiveness and safety of the intervention [25]. Placebo-controlled, double-blind trials with improved methods of randomization and more frequent data collection at larger intervals would help manage such limitations in the future. To do this, the study would seek to establish efficacy differences across the various cancer disease sites to inform more targeted implementation of the intervention. Similarly, cost-benefit analyses as to whether the intervention is cost-effective from an economic perspective vis–à–vis the potential clinic improvements are also deserving before large-scale implementation.

Several significant differences from the control group in all efficacy outcomes, favoring the intervention versus usual care, in cancer patients over 2 years. The longer PFS, OS, QoL, higher tumor response and reduced inflammation all describe the overall patient advantage from the intervention. However, equating toxicity rates and study limitations poses cautious approach to the results. The findings must be confirmed through other rigorous research designs; moreover, the course of the intervention, and the specific patient population that is benefiting from the intervention, must be identified. It could

also help ascertain the cost-effectiveness in areas where clinical outcomes may be improved more than the costs incurred. Currently, the clinician may want to use the intervention only for patients similar to the study participants, which is more research is needed to determine standard practice.

Conclusion

This two-year study of a randomized control trial indicated that the intervention may be effective at improving outcomes over the control group. However, no significant differences were observed at the baseline, but the intervention group had statistically significant higher retention rates at least 12 months follow up 75% vs 65%, p= 0.034, 18 months follow up 63% vs 50%, p=0.012 and 24 months follow up 55% vs 35%, p= 0.001. Likewise, immunization coverage rates were also higher among the intervention group during the end of the first year 12 months 82% as compared with 70% p = 0.045, 18 months 70% as compared with 55%, p = 0.019 and 24 months 60% as compared with 40%, p = 0.003. The intervention also demonstrated over time a progressive improvement in mean quality of life scores, starting with 54.8 at baseline assessment, then rising to 70.2 at the 24 months follow-up ($p<0.05$). In contrast, the control group means have either remained static or deteriorated. Overall, the intervention offered significantly improved tumor response rates compared to no intervention (RR=4.29, p = 0.001); there was reduced disease progression (13% vs 35%). As for the AE, no statistically significant difference was recorded between the 2 groups However, the intervention group showed a significantly lower biomarker level of CRP [8.2 (95 % CI = 7.4–9.2) vs 10.4 (95 % CI = 9.3–11.7) mg/L; p = 0.001], IL-6 [12.5 (95 % CI = In general, the intervention has much potential for increasing clinical benefits, enhancing the quality of life, tumor response rate, and inflammation levels. Additional research in larger randomized trials is consequently encouraged to supplement this evidence.

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