A feasibility trial of acupuncture in cancer patients undergoing radiotherapy treatment

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Abstract
Objective: We conducted a feasibility trial of acupuncture in cancer patients undergoing radiotherapy treatment. The trial included training radiographers to deliver acupuncture within patients' routine NHS care.
Methods: Mixed methods pragmatic randomized parallel-group exploratory feasibility trial comparing standard care to standard care plus acupuncture.
Results: Most aspects of the research design and acupuncture intervention were acceptable to the 101 participants. Participants' valued the opportunity to receive acupuncture within their NHS care, perceived the treatment as eliciting a number of beneficial effects, and had a positive impact on their NHS cancer treatment. However, quantitative analysis of outcome measure data revealed no consistent significant differences between those receiving standard care and those receiving standard care plus acupuncture.
Conclusion: It is feasible to implement acupuncture in a busy radiotherapy unit provided by specially trained radiographers. The methodology employed appears acceptable for the evaluation of acupuncture for radiotherapy patients.

1. INTRODUCTION

Cancers are among the leading causes of morbidity and mortality worldwide, with approximately 9.6 million deaths attributed to cancer in 2018 [1]. Many cancer patients receive radiotherapy treatment as a curative measure, either as a standalone treatment or in combination with other cancer treatments, such as chemotherapy. However, cancer patients typically experience a number of symptoms as a consequence of their disease and its treatment with radiotherapy. Acupuncture has been used extensively for symptom management in cancer [2-4]. An overview of reviews included all review papers published between 2000–2011 where the main focus of the paper was acupuncture for symptom management in cancer [5]. A number of additional reviews have been published subsequently [6-10]. Collectively these reviews suggest acupuncture may be an effective intervention for various cancer related symptoms, including fatigue, nausea and vomiting, xerostomia, hot flushes, lymphoedema, anxiety, and pain.

However, many trials of acupuncture for cancer related symptoms have evaluated acupuncture under control conditions. Typically this involves comparing acupuncture with needles inserted at points traditionally associated with alleviating those symptoms compared to a 'sham' or 'placebo' acupuncture intervention. Pragmatic trials, which evaluate acupuncture as practised, fully integrated in a routine clinical setting, have been less frequently published. Indeed only two randomised controlled trials of acupuncture within cancer could be identified which had employed a pragmatic design. Molassiotis et al published a pragmatic randomised controlled trial of acupuncture for cancer-related fatigue in patients with breast cancer, with findings indicating that the addition of acupuncture to standard care resulted in improved fatigue and quality of life for those participating [11]. While more recently Brinkhaus et al published a pragmatic randomised controlled trial of prophylactic acupuncture for chemotherapy breast cancer patients. The trial finding no difference in quality of life outcome measures between those receiving standard care plus acupuncture, compared to those receiving standard care alone [12].

Given the lack of previously published pragmatic trials of acupuncture for cancer patients we conducted a pragmatic feasibility trial of acupuncture for radiotherapy cancer patients, to evaluate the feasibility of delivering acupuncture to radiotherapy cancer patients in a routine clinical care National Health Service (NHS) setting.

2. METHODS

The study employed a pragmatic mixed methods randomised parallel-group exploratory design to determine the feasibility of delivering acupuncture within an NHS setting. This included preliminary data on the size of any effect and explored the views of patients about trial design and, for those allocated to the acupuncture intervention, their views on the intervention. A full list of feasibility study objectives and the methods by which they were achieved are presented in table 1. Patients were recruited from [NHS Trust] Radiotherapy Department.

Patient inclusion criteria:
-due to receive radical (curative) radiotherapy
-either gender and older than 16 years.
-any cancer diagnosis.
-willing to attend at least 3 acupuncture treatments if assigned to the acupuncture intervention.

Patient exclusion criteria:
-receiving treatment intended only to be palliative.
-unwilling to participate (for instance due to needle phobia).
-currently receiving acupuncture.
-platelet count <20 000mm.
-white blood cell count <1000mm.
-severe clotting dysfunction or who bruise spontaneously.
-unable to complete the questionnaires as judged by the investigators.

Randomisation was performed using the MinimPy program with sequential allocation of participants to the two treatment groups using minimisation. Participants were randomised using a ratio of 1:1 standard care to standard care plus acupuncture. Randomisation was stratified by gender, diagnostic group and patient age. The randomisation of patients to treatment arms was performed remotely by the [University] Cancer Trials Centre.

Patients who gave informed consent to participate completed baseline outcome measures with a member of the research team (T0) and were given a questionnaire pack containing outcome measures for additional time points: during treatment (at 2 weeks, T1), upon completion of the study intervention (T2), and 3 months after completion of the study intervention (T3). Completed outcome measures were returned in person to the [NHS Trust] Radiotherapy Department (T1 and T2) or posted back to the research team (T3). Mobile text messages were sent to participants at the 3-month post radiotherapy time point, to remind participants to complete and return their forms. Patients were also asked to participate in semi-structured interviews upon study completion. Telephone interviews were audio-recorded and transcribed verbatim.

Ethical approval for the study was obtained from London - Harrow Research Ethics Committee [Reference 15/LO/1012].

2.1 ART acupuncture intervention

A mixed methods approach was adopted to design the acupuncture intervention. A systematic review was conducted examining the treatments administered in papers reporting acupuncture treatment for cancer patients [13]. Subsequently, a one-day workshop was held with an acupuncture expert panel. Informed by the systematic review and their clinical expertise the expert panel devised and agreed the trial acupuncture intervention. Details of the process of designing the intervention have been published elsewhere [14].

As part of the study radiographers already employed within the study site were recruited to train in acupuncture and deliver the intervention. Three radiographers were recruited and completed a 4 day foundation course and 1 day course in treating cancer patients with the British Medical Acupuncture Society. Within the study radiographers treated patients for 30 minutes, with needles inserted for approximately 20 minutes of this time. Needles were inserted 10-30mm depending on the specific point, using 0.16x30mm and 0.25x30mm needles. Points were stimulated manually, no specific response (such as de qi) was sought.

The following acupoints were used:

1) Standard treatment protocol for all radiotherapy patients (for constitutional symptoms: fatigue, hot flushes, mood problems, anxiety, depression, and sleep problems):
Non traditional Anxiety, Sickness and Dyspnoea (ASAD) acupoints (over the manubrium in the midline, directly above and below CV21), LI4, LR3, SP6 and ST36 bilaterally, except when contraindicated as per the safe practice guidelines [15,16].
2) For patients at high risk for radiotherapy induced nausea and vomiting, PC6 bilaterally added.
3) Plus additional points based on specific pain symptoms.
4) Upper thoracic paraspinal points could be added for skin reactions to radiotherapy.

Patients were treated when they attended for radiotherapy, in a dedicated room in the radiotherapy department. Patients received 3-8 weekly acupuncture treatments, determined by the number of prescribed radiotherapy treatments.

2.2 Outcome measures

The following outcome measures were completed by participants:

European Organization for Research and Treatment of Cancer-Quality of Life Questionnaire-Core 30 Item (EORTC QLQ-C30): Specifically for cancer patients, covering five functional scales, three symptom scales, and a global health scale (all score ranges 0-100) [17].

Multidimensional Fatigue Inventory (MFI): Well-validated scale comprising 20 items measuring general fatigue including dimensions of physical and mental fatigue, activity, and motivation (all score range 4-20) [18].

Memorial Symptom Assessment Scale (MSAS): Multidimensional scale which evaluates 32 physical and psychological symptoms associated with cancer and its treatment: global distress (score range 0-40), physical symptoms (range 0-48), psychological symptoms (range 0-24), and total MSAS score (range 0-128) [19].

Visual Analogue Scale (VAS) of Quality of Life: Commonly used outcome measurement to monitor variations in patient reported quality of life. It is easy to complete and readily understood by cancer patients. The VAS was 10cm long, with participants able to place a mark where they felt it corresponded to their quality of life that day.

Sociodemographic and treatment characteristics: Obtained from the patients' medical records and the patients themselves. These included gender, age, educational level, marital status, cancer diagnosis, stage of disease, cancer treatment received and dosage.

2.3 Data Analysis

Quantitative data

Descriptive statistics and graphical representations of quantitative data were used to examine recruitment and retention rates. For each outcome measure, we produced the mean difference between the acupuncture and standard care groups at each timepoint, using a linear regression with the baseline outcome measure and trial groups as covariates. We report results for each timepoint separately to see the effects at these different times. We did not allow for having multiple analyses because this was a preliminary examination of the effect of acupuncture on the employed outcome measures.

Several participants had missing data at any timepoint after baseline. We therefore performed three sensitivity analyses based on data imputation. For a particular outcome item:

- Any missing value for a participant was assumed to be the same as the average of all the non-missing values for the same participant.
- Any missing value for a participant was assumed to be the same as the average of the non-missing values for the control participants at the same timepoint.
- A regression analysis was performed for each participant (using the non-missing outcome measure values and the timepoints), and the missing value was estimated from that regression.

Qualitative data

Telephone interviews were conducted with participants by consultants from Quality Health Ltd, a private company with extensive experience of patient surveys in cancer. The interviewer was aware of participants' treatment arm during the trial. Data were analysed inductively [20], using thematic analysis [21]. One of the researchers [JH] immersed themselves in the data, repeatedly reading the transcripts to understand participants' experiences. Key issues, concepts and themes arising from the data were identified to create a coding framework. Transcripts were coded and analysed thematically.

2.4 Recruitment and Sample

Eligible cancer patients routinely attending the Radiotherapy Department for planning prior to radiotherapy treatment were informed of the trial by therapy radiographers. Patients who expressed interest were given a patient information sheet and asked if they were willing to meet a member of the research team on days 1-3 of their radiotherapy treatment. Those willing to participate provided written consent. The target recruitment for the study was 100 cancer patients. This was based on a randomised trial of acupuncture in breast cancer [11], which found the standardised difference for general fatigue was 0.94. In our feasibility study, we aimed for a difference of ≥0.57, which required 100 patients in total (80% power and two-sided 5% statistical significance).

For qualitative patient interviews, all patients were approached with an initial phone call to obtain consent; if consent was given, the interview took place no less than 24 hours later.

3. RESULTS

As a feasibility study, our outcomes were feasibility driven rather than hypothesis driven. Findings are presented according to the specific aims of the feasibility study; namely recruitment processes and resources, intervention management and procedures, and suitability of outcome measures.

Recruitment Processes and Resources

Recruitment took place between September 2015 and June 2016. 353 patients were screened for inclusion; 205 patients declined to participate, 32 were not approached for consent, and 15 did not meet inclusion criteria. 101 patients agreed and consented to take part, representing an overall response rate of 29%. Of these, 50 were randomised to receive standard care plus acupuncture and 51 standard care alone (see figure 1). The age range for all participants was 24 to 84 (median 58), and 69 were female, 32 male. Patients with 17 primary tumours were recruited, the most common were: breast, prostate, gynaecological and sarcoma. Recruitment was skewed towards Caucasian ethnicity, higher educational attainment and female gender. Randomisation was successful, generating well-matched standard care and standard care plus acupuncture groups. Participant demographics can be seen in table 2. Ninety-one (90.1%) participants completed baseline assessments, 79 (78.2%) completed during treatment (at 2 weeks), 62 (61.4%) upon completion of the study intervention, and 60 (59.4%) 3 months after completion of the study intervention.

Twenty three participants took part in qualitative interviews, 12 of whom received acupuncture. Eleven stakeholders involved with the planning and execution of the feasibility study were additionally interviewed. Stakeholder interviews were conducted with radiotherapists delivering the acupuncture (n=2), acupuncturists acting as mentors to the radiotherapists delivering the acupuncture (n=2), radiotherapy managers (n=2), and members of the research team (n=5).

Qualitative interviews revealed participants' primary motivations for taking part in the study were a desire to help with research and to try acupuncture for themselves. The majority of participants indicated they did not have any preconceived expectations of participation in the study. When participants were asked for their views on why some patients declined to participant, the main perceived reasons were a fear of needles and a lack of available time. The randomisation process was acceptable to those participating, however most of those allocated to standard care indicated they were disappointed, at least initially, not to receive acupuncture. Although most participants were complimentary of the recruitment process, when asked for ways in which recruitment could have been improved, a small number of participants indicated that improvements to the initial information provided, particularly with reference to the timings of the acupuncture treatments, might have improved recruitment. Patients also suggested greater publicity of the study within the hospital might have led to further recruitment.

'I think the recruitment was brilliantly done. A bit more could have been said about the practical aspect of it and how the sessions were incorporated into your treatment. Time will be a big factor for some.' [ART15]

In terms of recruitment and resources, the research team and radiotherapy managers reported that the recruitment process took more time and co-ordination than estimated. The main reason stakeholders thought patients didn't want to take part or dropped out was the commitment/time involved in participating. They felt the main issues of providing acupuncture in UCH radiotherapy department was the small number of staff able to deliver acupuncture and the challenge those staff had to be able to fit acupuncture around their other commitments.

Intervention Management and Procedures

No issues were identified relating to the feasibility and acceptability of the trial procedures. All bar one participant indicated during interviews that they felt they had an accurate understanding of the study when they consented to take part. The overwhelming majority of participants who expressed a view also indicated the information presented to them was clear and understandable.

Those participants with no prior experience of acupuncture typically had no specific expectations from receiving treatment with acupuncture. Despite this lack of expectation many indicated they were 'curious' to experience acupuncture for themselves. Many were unsure of the likelihood of acupuncture eliciting any beneficial effects, with some expressing they were 'dubious' that acupuncture could elicit any positive effects. Despite this acupuncture naïve participants were confident acupuncture would not elicit any negative or adverse effects. However, for those with previous experience of acupuncture, either personal firsthand experience or those who had close friends or family who had received acupuncture, tended to have expectations that acupuncture could help them during their cancer treatment.

'I was dubious…… I thought it may help, it may not but you are being offered something. My expectation was not very much to be honest.' [ART07]

'I was hoping that whatever happened, it would help me. I know of people that it has helped. My wife has an arthritic hip and acupuncture helped her with that.' [ART11]

Those allocated to the acupuncture intervention experienced no difficulties attending treatments, although 2 participants dropped out before receiving treatment. All 48 participants who began acupuncture treatment attended all their acupuncture treatments, i.e. there was a 100% attendance rate for the acupuncture treatments. The range of treatments received was 3-8, with the mean number of treatments being 4.5 (median 4, mode 3). Of the 48 participants who received acupuncture treatment, 36 received the full standard treatment protocol, 7 received partial treatment throughout their treatment, while 5 received a partial treatment on at least 1 occasion due to full treatment being contraindicated as per safe practice guidelines [17,18]. Ten participants were additionally needled at PC6 for nausea and vomiting; 9 were needled at additional points for pain symptoms; and 4 were needled at upper thoracic paraspinal points due to skin reactions to radiotherapy. Four patients were withdrawn from the acupuncture group because of serious adverse events (SAEs). Since the control was standard care, there were no withdrawals from this group because of SAEs. The reported SAEs were: urgent eye surgery; sepsis secondary to pyometra; ascites and lymphoedema; hyperosmolar, hyperglycaemic state. All these SAEs were assessed as unrelated to acupuncture.

Participants perceived acupuncture, as delivered by newly trained radiotherapists, as comfortable to receive, with most experiencing no discomfort or adverse effects from treatment. A minority of participants indicated they experienced some discomfort, pain, bleeding, bruising or dizziness which was deemed minor and acceptable by participants. Almost all participants praised the skill of the radiotherapists delivering the acupuncture, with phases such as 'they were perfect' being common. The exception being A06 and A07 who felt the treating radiotherapists were 'amateur' and who expressed concerns over the training and experience of those delivering acupuncture. The overwhelming majority of participants felt receiving acupuncture was a relaxing experience, which was particularly valued at the point in time they were receiving radiotherapy treatment for their cancer.

'It was very easy and not uncomfortable at all…. It was all very professional. It felt like they knew what they were doing…. There were no side effects, maybe a bit of bleeding.' [ART10]

All participants received their acupuncture treatment on the day of their radiotherapy. However, participants were often unsure prior to attending whether the acupuncture would be provided before or after their radiotherapy. For many participants this was not perceived as being problematic. However, a small number of participants highlighted issues with the timing of acupuncture treatment, and indicated they would have preferred to have known in advance precisely at what point they would receive their acupuncture. It also meant that participants were unsure which of the trained radiotherapists they would be receiving treatment from. A number of participants indicated they would have preferred a continuity of care with the same person treating them each time. The majority of participants were happy with the room in which the acupuncture treatments were provided, with comments such as 'very nice, clean' [ART02] being common. However a few participants highlighted that their experience might have been improved further had the treatment room been larger and quieter.

'The sessions were convenient to attend. They were sometimes before, sometimes after radiotherapy treatment, but always fitted in well… It was well organised and ran smoothly as far as I was concerned.' [ART11]

Four patients were withdrawn from the acupuncture group because of serious adverse events (SAEs). Since the control was standard care, there were no withdrawals from this group because of SAEs. The reported SAEs were: urgent eye surgery; sepsis secondary to pyometra; ascites and lymphoedema; hyperosmolar, hyperglycaemic state. All these SAEs were assessed as unrelated to acupuncture.

Treating therapy radiographers reported delivery of the acupuncture caused or increased stress but was useful for patients. They were satisfied with the acupuncture training they received, reporting that it covered everything they needed to know, and that they felt confident to deliver the acupuncture.

Outcome measures

Although participants indicated during interviews that they were happy completing the study outcome measures, and found them easy to complete, some indicated they found the outcome measures 'repetitive', while two participants indicated they found the questionnaires 'tedious' or 'boring.' Importantly the majority of participants indicated that the outcome measures employed in the study did measure everything they felt was relevant to them.

Qualitative stakeholder interviews indicated that in terms of outcomes they felt that acupuncture had a positive effect on patient experience and cancer symptoms; both for well-being and symptoms. Fatigue, nausea and insomnia were mentioned as responding well to treatment by treating radiographers. Most stakeholders felt the provision of acupuncture was beneficial to patients.

When asked about treatment effects, participants themselves typically perceived their acupuncture treatment as reducing their stress and anxiety levels during their radiotherapy treatment. Although some participants indicated they did not perceive themselves as having any adverse symptoms from their radiotherapy treatment, a number of participants also reported experiencing a range of beneficial effects in terms of the alleviation of symptoms of cancer and the side effects of conventional treatment which they attributed to receiving acupuncture. Symptoms perceived as being alleviated by acupuncture included fatigue, nausea and vomiting, pain, sleeping problems, and dyspnoea. These effects left participants feeling they had an improved wellbeing and were more 'positive' and 'empowered'. Again the exception being A06 who felt acupuncture did not help with the symptoms of their radiotherapy. For some the effects of acupuncture were perceived as having a substantial impact on their symptoms. For example ART03 who initially experienced severe symptoms of nausea and vomiting, which was for them their most debilitating symptom, who perceived acupuncture as completely alleviating their symptoms. However, for some participants the beneficial effects of acupuncture were perceived as being relatively short lived, typically three days, with symptoms returning after this point. In light of this two participants indicated they would have preferred to have received acupuncture treatment more frequently during radiotherapy. Whilst other participants felt that effects were cumulative, with effects being more prolonged as the course of treatment continued. While other participants indicated they felt they would have benefitted from receiving treatment with acupuncture beyond the duration of their radiotherapy treatment, as side effects from their cancer treatment continued beyond their radiotherapy treatment.

'My treatment was on a Wednesday and generally Thursday, Friday, Saturday I noticed quite a big improvement in myself because of treatment but then by Sunday, Monday, Tuesday it was back to not feeling very well, feeling tired and feeling nauseous and dizzy and that sort of thing.' [ART02]

'I would say it gave me more energy. It gave me an edge to get through the sessions. I didn't suffer from fatigue; I think the acupuncture had something to do with that. I also felt positive and empowered.' [ART08]

However, it should be noted that some participants were pragmatic when discussing potential benefits from acupuncture, noting that it was difficult to ascribe any benefit to acupuncture, due to having no personal

experience of receiving radiotherapy without acupuncture to compare their experience against. A number of participants, particularly those with no previous experience of acupuncture, indicated treatment with acupuncture had exceeded their expectations, and all participants indicated they would recommend acupuncture to other cancer patients undertaking radiotherapy treatment. While some participants, including those new to receiving acupuncture, also indicated they would consider acupuncture for any future ailments they suffered, due to the perceived positive impact on their cancer treatment.

'I was pleasantly surprised by how it all worked out. My expectations were exceeded by a long way….. I was a bit cynical before starting it but now it's something I would consider for other things as well.' [ART02]

Participants were almost universal in their perception of acupuncture having a positive impact on their cancer treatment within the NHS University Hospital. In addition to the perceived beneficial effects of acupuncture, many also valued the extra care they received as a result of receiving acupuncture delivered by one of the treating radiotherapists. This valued extra care included having additional allocated time with a treating cancer healthcare professional to discuss issues related to their care in a relaxing environment. Participants also valued the 'holistic' nature of acupuncture, and components of acupuncture, such as relaxation and an overall improved wellbeing.

'It was an added benefit. It gave me a more positive outlook. Radiotherapy is very clinical and this made it feel very holistic.' [ART08]

'It had a positive impact on my care.' [ART09]

'I thought it was an additional bonus. Although it was a study and not offered all the time, it was a nice touch…. Overall it had a positive effect. The NHS hasn't just thought of how to help you in a medical way, but also about your wellbeing.' [ART10]

Figure 2 shows differences in EORTC QLQ-C30 and MFI items at timepoints T2 and T3, among all participants. No single quality of life measure stood out as being associated with a consistent beneficial effect from acupuncture, at any time (the occasional apparent effect, e.g. nausea at T2, is likely to be a chance finding given the number of outcomes analysed).

Figure 3 (MFI instrument) suggests that acupuncture may have had beneficial effects on fatigue in women, and little/no effect in men. Statistically significant effects at T3 were seen among women for physical fatigue (mean difference -2.3, p=0.04), reduced activity (-2.9, p=0.045), and reduced motivation (-2.4, p=0.04). Benefits were also suggested among breast cancer patients at T3 for physical fatigue (mean difference -3.6, p=0.03), reduced activity (-4.1, p=0.03), reduced motivation (-2.8, p=0.09), and mental fatigue (-5.0, p=0.003). These two factors (women and breast cancer) will however be correlated. Furthermore, these are at best modest effects (the MFI scale range is 4 to 20), and the relatively small numbers of participants in each of these subgroups do not allow any reliable conclusions to be made. No consistent differences in any quality of life item were seen for other cancer types or participant characteristic (marital, educational or occupational status).

The influence of the number of acupuncture treatments on mean differences was examined. There appeared to be some benefit in patients who had only 3 sessions, but little/no evidence of benefit for those who had ≥4 sessions, which at first glance is counterintuitive. But these observations are confounded by the fact that participants received acupuncture when they attended for radiotherapy, so those who had the fewest acupuncture sessions also had the fewest radiotherapy treatments usually due to having less severe disease.

4. DISCUSSION

Acupuncture has been used extensively for symptom management in cancer, with reviews suggesting acupuncture may be an effective intervention for various symptoms [5-10]. However, pragmatic trials which evaluate acupuncture fully integrated in a routine clinical setting, have been less frequently published. Our pragmatic feasibility study is one of the first published studies to evaluate the feasibility of delivering

acupuncture to radiotherapy cancer patients in a routine clinical care National Health Service (NHS) setting. The findings from the study indicate that most aspects of the research design and administration of the acupuncture intervention were acceptable to patients and stakeholders involved in the study. To the author's knowledge, the study was the first to train clinical staff to administer acupuncture within a trial. The findings indicating it is both feasible and practical to train radiographers to deliver an acupuncture intervention. Treating radiographers and Department managers were satisfied with the acupuncture training received as part of the study. While the overwhelming majority of participants praised the professionalism and skill of the radiotherapists delivering the acupuncture.

Although typically participants qualitatively reported benefit from acupuncture, analysis of quantitative data identified only one treatment effect, on fatigue, and only in certain subgroups (women and breast cancer) and, counterintuitively, three months after treatment completion. This may be due to differential dropout, i.e. patients who did not respond to acupuncture might be less likely to return the 3-month post-treatment questionnaires. Though sustained effects and increasing between-group differences have previously been reported several months after completing treatment in other acupuncture studies [22]. Although participants typically qualitatively reported a number of other benefits from acupuncture, analysis of quantitative data revealed that no other single quality of life measure was consistently associated with a beneficial effect from acupuncture. This is similar to the findings of the recently published pragmatic trial by Brinkhaus et al [12], which also found disparities between quantitative and qualitative findings. Brinkhaus et al reporting that despite patients qualitatively reporting positive effects on psychological and physical wellbeing, no differences were found in outcome measures between patients receiving prophylactic acupuncture during chemotherapy, compared to those patients receiving no additional acupuncture. Brinkhaus et al speculate that their employed outcome measure (FACT-B) may not have been sensitive enough and/or the measurement time points not frequent enough, to detect the changes in patients [12]. The findings from both trials would suggest that further research is required to assess which outcome measures, and time points, should be employed in trials of acupuncture in cancer to detect changes qualitatively reported by patients. It should also be noted that the trial was powered to detect a treatment effect of 0.57 (standardised difference), which is considered to be a reasonably moderate to large effect [23]. But if acupuncture has only small to moderate effects in cancer patients who receive radiotherapy, the trial was insufficiently powered to detect these. Further research would be required to explore this further.

Although the trial acupuncture intervention was designed by an expert panel, and employed a rigorous methodological approach to its design [14], data from the feasibility study reveal a number of ways in which the intervention could have been improved for participants. Qualitative data revealed that some participants perceived the effects of acupuncture as diminishing over a few days, and it is possible that twice weekly treatments may have improved effects. It is also possible that treatments effects could have been improved by continuing treatment post radiotherapy treatment to address ongoing side effects, and ensuring participants received treatment from the same radiographer at each acupuncture treatment.

The main study limitations are the trial being single centre, lack of blinding, choice of control intervention, and having a heterogeneous patient group. Because patients knew which arm they were in, it is plausible that the placebo effect could contribute to the modest treatment effects observed in fatigue. We performed multiple analyses, some are statistically significant, but one must assume that some of this is due to chance, because of the multiple analyses. Patient heterogeneity was due to employing a pragmatic trial design. This follows from the question which we sought to answer: does adding acupuncture to standard care improve quality of life compared to standard care alone?

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Conflicts of interest
The views expressed in this article are those of the author(s). The authors declare that they have no conflicts of interests.

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Table 1: Feasibility objectives and methods by which they were achieved

1. Recruitment Processes and Resources	
Feasibility Objectives	**Ways in which objectives were achieved**
Eligibility: number of radiotherapy patients eligible for recruitment	Number of radiotherapy cancer patients treated at UCH Radiotherapy Department; study researcher monitoring on-site for numbers eligible for inclusion; stakeholder qualitative interviews.
Recruitment: ability to recruit patients into the study.	Number of patients consenting to participate; study researcher monitoring on-site; stakeholder qualitative interviews; patient qualitative focus groups/interviews.
Recruitment: numbers declining to take part and reasons.	Study researcher monitoring of site; stakeholder qualitative interviews; patient qualitative focus groups/interviews.
Randomisation: willingness to be randomized.	Patient qualitative focus groups/interviews.
Retention: Across the duration of the intervention.	Quantitative data on drop out rates; patient qualitative focus groups/interviews; stakeholder qualitative interviews.
Long term patient follow up.	Rates of completion and drop out at each stage; patient feedback from qualitative focus groups/interviews; stakeholder qualitative interviews.
Study timeline.	Time taken to recruit and complete the study, data collection and analysis.
2. Intervention Management and Procedures	
Feasibility Objectives	**Ways in which objectives were achieved**
Attendance (compliance) for acupuncture treatment.	Participant attendance for acupuncture treatments; patient feedback from qualitative focus groups/interviews; stakeholder qualitative interviews.
Acceptability of the acupuncture intervention.	Patient feedback from qualitative focus groups/interviews; stakeholder qualitative interviews.
Acceptability and appropriateness of the trial design.	Patient feedback from qualitative focus groups/interviews; stakeholder qualitative interviews.
To better determine how to ensure and maintain quality in the delivery of the acupuncture intervention.	Patient feedback from qualitative focus groups/interviews; stakeholder qualitative interviews.
Ability of newly trained therapy radiographers to deliver the acupuncture intervention.	Patient feedback from qualitative focus groups/interviews; stakeholder qualitative interviews.
Level of acupuncture training necessary to deliver the acupuncture intervention.	Patient feedback from qualitative focus groups/interviews; stakeholder qualitative interviews.
Develop and understand our primary and secondary outcomes for a larger fully-powered study.	Analysis of quantitative outcome measures ; patient feedback from qualitative focus groups/interviews
3. Outcome Measures	

Feasibility Objectives	Ways in which objectives were achieved
Determine the acceptability of the selected questionnaires and patient's willingness to complete them.	Data on completion rates; patient feedback from qualitative focus groups/interviews.
Describe means and standard deviations of patient reported outcome measures.	Quantitative data analysis.
Determining the usefulness of study outcome measures.	Correlating quantitative outcomes with qualitative patient focus groups/interviews
Develop a sample size calculation.	Power calculations based on quantitative data.

Table 2. Participant demographics

	Acupuncture N=50	Control N=51
Age, years; median (range)	56 (29-84)	58 (24-76)
	Number (%)	
Female	34 (68)	35 (69)
Male	16 (32)	16 (31)
Marital status		
Single/widowed	15 (30)	20 (39)
Married	23 (46)	24 (47)
Divorced/separated	10 (20)	7 (14)
Missing	2 (4)	0 (0)
Ethnic origin		
Caucasian	40 (80)	39 (76)
Non-Caucasian	7 (14)	11 (22)
Missing	3 (6)	1 (2)
Educational level		
Primary school	0	2 (4)
Secondary school	11 (22)	9 (18)
College/diploma	13 (26)	16 (31)
Graduate	23 (46)	21 (41)
Missing	3 (6)	3 (6)
Occupational status		
Employed	22 (44)	19 (37)
Unemployed/retired	18 (36)	26 (51)
Other	7 (14)	4 (8)
Missing	3 (6)	2 (4)
Occupational group		
Skilled (manual/non-manual)	6 (12)	7 (14)
Professional, managerial, technical	37 (74)	31 (61)
Other	3 (6)	10 (20)
Missing	4 (8)	3 (6)
Religion		
Christian	24 (48)	27 (53)
Other	6 (12)	11 (22)
No beliefs/prefer not to say	17 (34)	12 (24)
Missing	3 (6)	1 (2)
Cancer		
Breast	20 (40)	17 (33)
Cervix/endometrial	5 (10)	9 (18)
Gastrointestinal/bladder	4 (8)	4 (8)
Head & neck	2 (4)	1 (2)
Prostate	8 (16)	5 (10)
Sarcoma	7 (14)	9 (18)
Other	4 (8)	6 (12)