Table 1: Clinical trials of intravenous high-dose vitamin C for cancer

Source: Luc Geeraert, CAM-Cancer Consortium. Vitamin C (Intravenous high-dose [online document] July 2014.

First author, year, (ref)	Study design	Participants (number, diagnosis)	Interventions (experimental treatments, control)	Main outcome measures	Main results	Comments (critical evaluation, weaknesses, etc)
Controlled clinical trials						
Ma et al. 2014 (37)	randomized controlled	27 patients with newly diagnosed stage III/IV ovarian cancer	treatment group: intravenous vitamin C (75 or 100 g, twice weekly, for 12 months) combined with 6 months paclitaxel/ carboplatin; control group: paclitaxel/ carboplatin only	adverse events; 5-year follow-up for survival	reduction of chemotherapy-associated toxicity	the control group did not receive a placebo
Retrospective controlled studies						
Cameron and Pauling 1976 (11)	controlled retrospective	comparing 100 terminal cancer patients receiving vitamin C with 1,000 historical control patients	vitamin C (10 g intravenously per day for about 10 days and orally thereafter, or only oral) as only treatment	survival	4-fold increased average survival time in vitamin-C-treated group	some patients received oral vitamin C and not intravenous; short treatment period; doses rather low
Cameron and Pauling 1978 (12)	controlled retrospective	comparing 100 terminal cancer patients receiving vitamin C with 1,000 historical control patients	vitamin C (10 g intravenously per day for about 10 days and orally thereafter, or only oral) as only treatment	survival	5-fold increased average survival time in vitamin-C-treated group	some patients received oral vitamin C and not intravenous; short treatment period; doses rather low
Cameron and Campbell 1991 (50)	controlled retrospective	comparing 294 incurable cancer patients receiving vitamin C with 1,532 control patients	vitamin C (10 g intravenously per day for about 10 days and orally thereafter, or only oral) as only treatment	survival	2-fold increased average survival time in vitamin-C-treated group	some patients received oral vitamin C and not intravenous; short treatment period; doses rather low
Vollbracht et al. 2011 (51)	epidemiological retrospective cohort study	comparing 53 breast cancer patients receiving vitamin C with 72 control patients	intravenous vitamin C (7.5 g, once weekly, for ≥4 weeks) combined with standard anticancer therapy	adverse events	intravenous vitamin C was well-tolerated; improved quality of life; no effect on tumour status	applied doses were low

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Uncontrolled studies						
Riordan et al. 2005 (38)	uncontrolled	24 late-stage terminal cancer patients	intravenous vitamin C (0.15-0.71 g per kg body weight, daily, for up to 8 weeks) as only treatment	adverse events; radiographic images for tumour progression	intravenous vitamin C was well-tolerated; 2 patients discontinued and one patient had stabilized disease during the trial	applied doses were low; plasma concentrations did not exceed 3.8 mM
Yeom et al. 2007 (39)	uncontrolled	39 terminal cancer patients	vitamin C (10 g intravenous twice, and 4 g oral daily, for 1 week) as only treatment	quality of life	patients reported significantly lower scores for fatigue, nausea/vomiting, pain, and appetite loss; other function and symptom scales not significantly changed	applied doses were low; very short treatment period
Hoffer et al. 2008 (1)	dose-escalating, uncontrolled	24 patients with advanced cancer or hematologic malignancy not responding to standard therapy	intravenous vitamin C (0.4-1.5 g per kg body weight, 3 times per week, for up to 30 weeks) as only treatment	adverse events; pharmacokinetics	intravenous vitamin C was well-tolerated; pharmacokinetics and recommended dose were determined; no objective anti-cancer response	
Monti et al. 2012 (40)	dose-escalating, uncontrolled	14 subjects with metastatic pancreatic cancer	intravenous vitamin C (50, 75, or 100 g, 3 times per week, for up to 8 weeks) combined with gemcitabine and erlotinib	adverse events; CT imaging for therapeutic response	decrease in primary tumour size; no adverse events other than expected for progression of cancer and/or gemcitabine and erlotinib treatment	short treatment period
Stephenson et al. 2013 (2)	dose-escalating, uncontrolled	17 patients with advanced solid tumours not responding to standard therapy	intravenous vitamin C (30-130 g/m^2, for 4 consecutive days per week, for 4 weeks) as only treatment	adverse events; quality of life; pharmacokinetics	intravenous vitamin C was well-tolerated; pharmacokinetics and recommended dose were determined; no objective tumour response	

Uncontrolled studies cont.						
Welsh et al. 2013 (41)	uncontrolled	9 patients with biopsy-proven stage IV pancreatic adenocarcinoma	intravenous vitamin C (15-125 g, twice weekly, for 69-556 days) combined with gemcitabine	adverse events; time to progression and overall survival	combination with gemcitabine was well-tolerated; statistically non-significant suggestion of efficacy	not powered for efficacy evaluation
Mikirova et al. 2012 (52)	uncontrolled retrospective	45 patients with different cancers after completion of conventional anticancer therapy	intravenous vitamin C (7.5-50 g, for 1-100 treatments) as only treatment	C-reactive protein; parameters of inflammation; cancer markers; level of pro-inflammatory cytokines	modulation of inflammation correlating with decreases in tumour marker levels	

Case series/studies						
Cameron and Campbell 1974 (42)	uncontrolled	50 cases of advanced cancer	intravenous and/or oral vitamin C (5-45 g per day, indefinitely) as only treatment	adverse events; therapeutic response	3 patients with cytostasis, 5 with tumour regression, 4 with tumour hemorrhage and necrosis; improvement in quality of life; no major side effects	applied doses were low; some patients with positive effect on tumour growth received oral vitamin C; short treatment period
Riordan et al. 1990, 1995, 1996, 1998, 2000 (43-47)	uncontrolled	8 cases of metastasized cancers	intravenous vitamin C (15-100 g, twice weekly, long periods of time) as only treatment or combined with conventional therapy	adverse events; therapeutic response; radiographic images; physical examination	7 patients with remission; intravenous vitamin C was well-tolerated	
Drisko et al. 2003 (48)	uncontrolled	2 cases of advanced epithelial ovarian cancer	intravenous vitamin C (60 g, twice weekly to once in 2 weeks, indefinitely) for 1 patient combined with consolidation chemotherapy	biomarker monitoring; radiographic images; physical examination	2 patients disease-free 3 years after diagnosis; intravenous vitamin C was well-tolerated	

Case series/studies cont.						
Padayatty et al. 2006 (49)	uncontrolled	3 well-documented cases of advanced cancers	intravenous vitamin C (15-65 g, 2 times per week, for >2 months, lower treatment frequencies thereafter) as only treatment	clinical details were examined in accordance with National Cancer Institute Best Case Series guidelines; independent pathologic confirmation of tumour	3 patients with remission	