

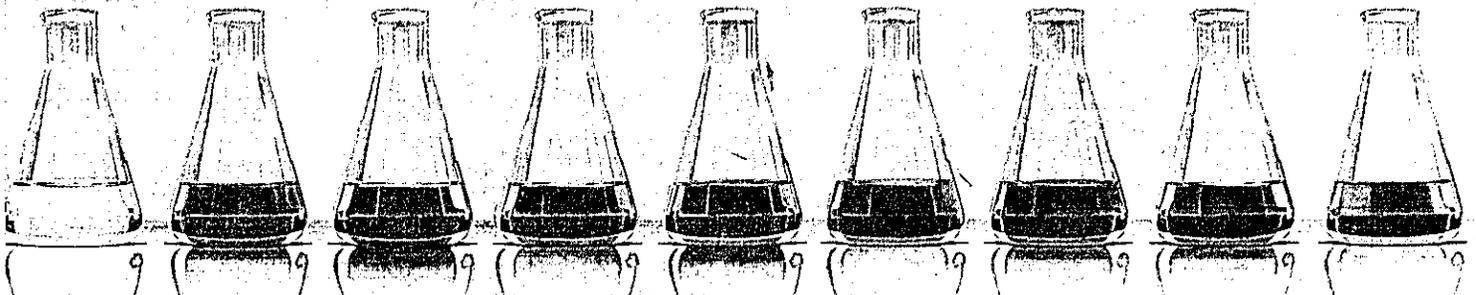
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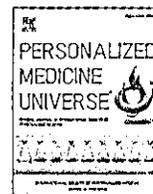
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## Case report

## High dose IV vitamin C for treatment of prostate adenocarcinoma

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## ABSTRACT

Prostate cancer is one of the common cancers seen in males. Earlier studies that have used intravenous (IV) or oral vitamin C have shown an improvement in symptoms of cancer patients and have prolonged life in terminally ill cancer patients. Today, evidence suggests that high doses of intravenous vitamin C ranging from 50 to 100 g can increase the plasma concentration of vitamin C to 14000  $\mu\text{mol/L}$ . When the concentration of vitamin C in the plasma is about 1000  $\mu\text{mol/L}$ , vitamin C is selectively toxic to cancer cells. We report here a case study of a patient who has diagnosed prostate cancer of Gleason's pattern 7. We found that, at the end of ten months of treatment with high dose IV vitamin C, the vascular tumor that was present before on the left mid-gland area of the prostate was no longer detectable on the ultrasound. In the light of the recent evidence showing anti-tumor activity of vitamin C, the role of high dose IV vitamin C for cancer should be considered further.

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## 1. Introduction

Prostate cancer is the second most common cancer in men after skin cancer in United States of America [1]. According to American Cancer Society, there will be 238,590 new cases of prostate cancer that will occur in the United States in the year 2013 [1]. Some of the risk factors for prostate cancer include, increasing age, African-American race and a positive family history of prostate cancer. Although digital rectal exam (DRE) and prostate specific antigen (PSA) are commonly used in the diagnosis of prostate cancer, currently, there are no screening studies that can detect the cancer at an early stage. Early prostate cancer usually has no symptoms but, in advanced stages it can weaken or slow the urinary stream, increase the urinary frequency, cause nocturia, hematuria and occasionally impotence [1]. Prostate cancer if metastatic, usually invades the bone, spine and ribs.

Some of the factors taken into account while treating prostate cancer include: the age of the patient, expected life span, other comorbidities and stage and grade of the cancer [1]. The common treatment options include watchful waiting, surgery, radiation therapy, chemotherapy, hormone therapy and vaccines [1]. Additional therapies not included in the common guidelines include alternative therapies such as high dose IV vitamin C. Several case reports of apparent responses by malignant disease to IV vitamin C therapy have been reported [2–7]. In the case study described

below we report a case of prostate adenocarcinoma that was treated with high dose IV vitamin C for ten months followed by a radical prostatectomy and lymph node dissection. We saw positive outcomes at the end of ten months of treatment.

## 2. Case study

A 57 year old, African-American male presented to the office for a routine health visit. The patient has a family history of prostate cancer in father. He does not take any medications and is generally healthy. Patient was diagnosed with benign prostatic hypertrophy in 2008 through trans-rectal ultrasound. The initial ultrasound of the prostate in 2008 showed no vascular areas, one mid-gland posterior avascular area measuring 4 × 4 mm and an irregular prostate. The prostate measured 47 × 32 × 41 mm × 0.52 with a volume of 32 cc.

A repeat ultrasound of the prostate (Fig. 1) was performed in 2010 due to increasing PSA level and positive family history of cancer. The ultrasound showed a vascular area on the left mid-base of the prostate measuring 4 × 5 mm, a vascular area on the left mid-lateral prostate measuring 3 × 4 mm and an irregular prostate. The prostate measured 47 × 32 × 41 mm × 0.2 with a volume of 32 cc.

A biopsy of the prostate gland was also taken at the same time. Needle biopsy of the left lobe of the prostate showed prostatic adenocarcinoma, Gleason's pattern 7 (3 + 4), involving approximately 50% of the tissue. The tumor was present in 3 out of 3 fragments. Needle biopsy of the right lobe of the prostate showed benign prostatic hyperplasia and no presence of tumor. Needle

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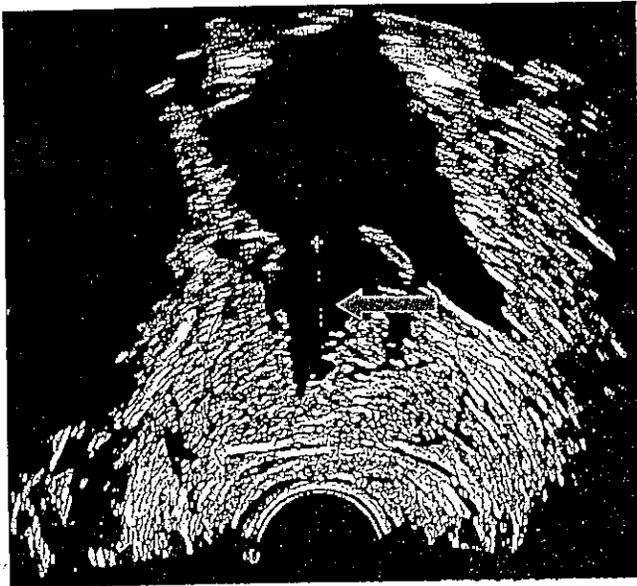


Fig. 1. The figure shows trans-rectal ultrasound of the prostate gland. The irregular black area as shown by the arrow points to the vascular lesion on the prostate gland.

biopsy of the trans zone of the prostate showed prostatic adenocarcinoma, Gleason's pattern 7 (3 + 4), involving approximately 35% of the tissue. The tumor was present in 3 out of 8 fragments. High grade prostatic intraepithelial neoplasia and perineural infiltration with the tumor were also identified. Patient's MRI in 2010 which did not show any extra-capsular disease.

The patient then presented to our office in 2011. Initial laboratory testing at the office showed the following: PSA-5.86, hemoglobin-13.5, hematocrit-42.7, WBC-4.8, BUN-12, creatinine-1.3, free testosterone-5.8, CEA-2.1, CA19-9-30.7, CA-125-8.9 and CA27.29-22.4. His liver function tests and alkaline phosphate levels were normal. The next set of lab tests were repeated one year later in 2012, where his PSA had risen from 5.86 to 7.61.

Due to the rising PSA, patient opted to receive high dose IV vitamin C therapy. The patient was treated at The Salerno Center for Complimentary Medicine in New York. The patient was given 25–50 g of IV vitamin C twice a week for ten months. The high dose IV vitamin C therapy was followed by glutathione, which is a strong antioxidant. At the end of 10 months, the prostate ultrasound (Fig. 2) in 2012 showed no vascular areas, a left mid-lateral avascular area, measuring 5 × 12 mm and an irregular prostate that had improved when compared to the previous study. The volume of the

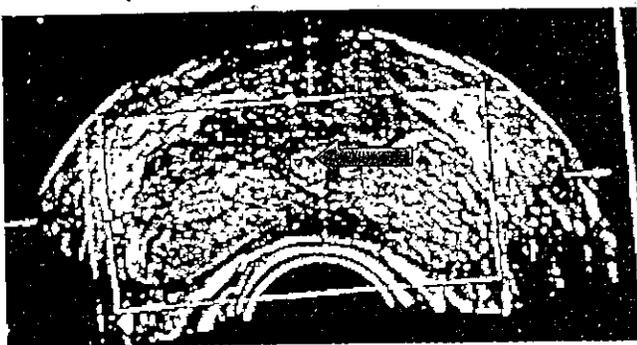


Fig. 2. The figure shows trans-rectal ultrasound of the prostate after treatment with vitamin C. The arrow points to the resolution of the irregular vascular area that was depicted in Fig. 1. This improvement was seen ten months after the treatment with high dose intravenous vitamin C.

prostate was 49 cc. The prostate tumor that was Gleason's pattern 7 was now not detectable on the ultrasound.

The patient additionally took Nature-Throid, Salerno Abe Factors and received IV chelation therapies. At the end of 10 months of treatment the PSA level was 8.06, although the ultrasound did not show any vascular areas. The patient currently continues to receive high dose IV vitamin C therapy.

### 3. Discussion

Vitamin C has been suggested as having both a preventative and therapeutic role in a number of pathologies when administered at much higher-than-recommended dietary allowance levels [8]. We came across three case studies of three different types of cancer where high doses of IV vitamin C was used for the treatment of cancer in addition to either tumor resection or radiation therapy [9]. In all the three cases, the patients showed an improvement in cancer symptoms and regression of the disease. Additionally, in all the cases high dose IV vitamin C also prolonged the lives of these cancer patients. Using this rationale, we also treated our patient with high dose IV vitamin C for prostate cancer and had a positive outcome. The three cases that we researched, and our case reported here, increase the clinical plausibility of the notion that vitamin C administered intravenously in high doses might have a positive outcome in cancer patients.

Pharmacokinetic data have shown that vitamin C when administered orally is tightly controlled in the plasma and cell concentrations [9]. Patients that consume 200–300 mg of vitamin C per day, have fasting steady state of plasma concentration of about 70–80  $\mu\text{mol/L}$  [10,11]. Even with a maximal oral dose of 3 g every 4 h, the estimated peak plasma concentration of vitamin C reaches a level of about 220  $\mu\text{mol/L}$  [12]. Vitamin C when administered intravenously stays longer in the plasma until a homeostasis is reached by renal excretion. Depending on the rate of infusion and amount of vitamin C given intravenously, the plasma concentrations can reach a level of 14000  $\mu\text{mol/L}$  [9]. Concentrations of vitamin C in the plasma >2000  $\mu\text{mol/L}$  can stay in the plasma for a longer period of time [9].

At normal physiologic concentrations, vitamin C acts as an antioxidant that inactivates reactive oxygen species. However at high pharmacologic concentrations vitamin C acts a pro-oxidant by generating oxidative species such extracellular hydrogen peroxide [13,14]. This hydrogen peroxide generated is delivered to tissues but not found in the blood [9]. Several in vitro studies have shown that the extracellular vitamin C, that generates hydrogen peroxide, kills away the cancer cells selectively but does not harm the normal cells [13]. This vitamin C mediated cancer cell death, is only obtained when vitamin C is administered intravenously.

The mechanism of action of vitamin C is intricate, yet deadly to the cancer cells. Extracellular hydrogen peroxide from high doses of vitamin C diffuses into the cancer cells and causes toxicity in these cells by ATP depletion which eventually leads to cell death [16]. Additionally, hydrogen peroxide toxicity compromises membrane glucose metabolism and DNA integrity in the cancer cells [16]. In the normal cells hydrogen peroxide is readily neutralized by antioxidant enzymes such as catalase, glutathione peroxidase and superoxide dismutase. The level of these enzymes in cancer cells is low which causes the toxicity and cancer cell death [15].

Additionally, the patient also took the Salerno Abe Factors which contains Green Tea Leaf extract, L-Carnosine, Quercetin, Alpha Lipoic Acid, Resveratrol and Benfotiamine, the highest available concentrations in the world. All the nutrients mentioned here have powerful antioxidant capabilities. Additionally, studies have shown that Quercetin exerts a direct, pro-apoptotic effect in tumor cells and blocks the growth of several human cell lines at different phases of the cell cycle [17].

Emerging evidence now shows that concentrations of vitamin C at a concentration of 1000–5000  $\mu\text{mol/L}$  are selectively toxic to cancer cells [9]. This concentration is achieved only through intravenous administration of vitamin C. In the case report presented above, using high dose IV vitamin C, we were able to show that the vascular area in the prostate gland disappeared after about 10 months of treatment. These data confer some validation that vitamin C can offer anti-tumor effects and further studies are warranted to learn its complete role.

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