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Case Report

Fenbendazole as an Anticancer Agent? A Case Series of Self-Administration in Three Patients

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Keywords

Fenbendazole · Veterinary medication · Antiparasitic · Case rep · Repurposed drug · Benzimidazoles · Advanced cancer · Cancer regres

Abstract

Background: Fenbendazole (FBZ), an inexp ve widely accessible antiparasitic drug used in veterinary medicine, has garnered gro ng nt rest for its potential as an anticancer therapy. Preclinical studies suggest that BZ ex its anticancer effects through a wide variety of mechanisms. While FBZ has show mise both in vitro and in vivo studies, clinical evidence supporting its use and efficacy in ing metastatic cancer is currently limited. ***Case Presentations:*** This report ghlights 3 cases of patients with advanced cancer – including breast, prostate, and melan a. T o patients achieved complete remission, and one achieved near-complete remissi ft orporating FBZ into their treatment regimens alongside other therapies (excludin ch herapy). All three patients tolerated FBZ without any reported adverse effects, nd re is on was sustained during follow-up periods ranging from 11 months to nearly 3 y ***Co lusion:*** FBZ demonstrates potential as a novel promising therapeutic option r pu sing in oncology. Its ability to contribute to tumor regression and achieve disease sion warrants further clinical research to establish its efficacy and optimize its use.

Background

Fenbendazole (FBZ) is a benzimidazole anthelmintic commonly used to treat a variety of animal parasitic infections. In recent years, the use of FBZ as either a standalone cancer treatment or as a complementary therapy alongside chemotherapy has gained significant attention among individuals battling various types of cancer [1]. FBZ, an inexpensive

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antiparasitic drug widely used in veterinary medicine, is readily accessible through animal supply stores, online platforms and pharmaceutical chemical manufacturers. FBZ was originally patented by Hoechst AG (now part of Sanofi) but the patent expired in the early 1990s, making FBZ available as a generic drug. FBZ has shown potential in both in vitro and in vivo models of cancer, as evidenced by studies such as those conducted by Song et al. [2]. Benzimidazoles, including FBZ, exert anticancer effects through several mechanisms: they disrupt microtubule polymerization, induce apoptosis, arrest the cell cycle at the G2/M phase, inhibit angiogenesis, and interfere with both glucose [3] and probably also glutamine [4] metabolic pathways. Although there is increasing interest in FBZ and its potential application for treatment of advanced cancer, the evidence available in the published literature regarding its efficacy remains limited, and there is a substantial lack of clinical research to support its role as an anticancer treatment. This report follows the CARE Checklist and presents three cases of advanced cancer, in which 2 patients achieved complete remission and one achieved near-complete remission following the use of FBZ.

Case Presentations

Case 1

An 83-year-old female was diagnosed with stage 4 breast cancer in October 2021. She was initially diagnosed in 2009 with estrogen receptor-positive breast cancer, treated with bilateral mastectomy, reconstruction, and aromatase inhibitors (later discontinued). She remained disease-free until a recurrence was diagnosed in 2021. Immunohistochemistry revealed strongly positive for cytokeratin 7, cytokeratin oscar, GATA binding protein 3 (GATA3), and cluster of differentiation 68 (CD68). The patient underwent an esophagogastroduodenoscopy with endoscopic retrograde cholangiopancreatography due to biliary obstruction requiring stent placement. During that procedure, she underwent a fine needle aspiration of her liver, which confirmed metastatic breast carcinoma characterized as ER/PR positive and HER-2/neu negative. Ascitic fluid analysis also confirmed metastatic breast carcinoma. Magnetic resonance imaging of the spine in October 2021 revealed metastatic breast cancer involving multiple bones, including T10, T12, L1, L2, L3, L4, L5, S1, S2, and the iliac bones. PET/CT scan on December 29, 2021, showed six hypermetabolic lung lesions, the largest located in the central right upper lobe measuring 2.8 × 1.5 cm (SUV max 8.4), a posterior right lower lobe lesion measuring 1.8 × 1.4 cm (SUV max 4.6), and a left upper lobe lesion measuring 0.8 cm (SUV max 4.4). There were hypermetabolic liver lesions in the left hepatic lobe, with the index lesion in the medial left hepatic lobe measuring 2.9 × 1.7 cm (SUV max 5.6) and hypermetabolic bone lesions, notably a 5.0 × 2.9 cm lytic lesion in T12 (SUV max 6.8) extending into the spinal canal, and a 2.0 cm lesion in T12 (SUV max 3.5). The patient declined further conventional chemotherapy or radiation therapy and was placed under hospice care. On November 22, 2021, she began self-administering FBZ daily at a dose of 222 mg. In December 2021, she received fulvestrant injections (an estrogen receptor blocker) intended to inhibit cancer growth in a manner similar to restricting glucose. In January 2022, she underwent targeted radiation for two painful spinal metastases. These tumors disappeared rapidly, relieving her pain within a few days. She continued taking 222 mg/day of FBZ for 8 months. During this time, her liver enzymes normalized, and her CA 27.29 dropped from 316 (November 2021) to 36.6 (July 2022) (see online suppl. Material; for all online suppl. material, see https://doi.org/10.1159/000546362). On April 20, 2022, a PET scan confirmed the absence of any abnormal metabolic activity indicative of cancer. This was corroborated by the steady decline in her CA 27.29 levels, which can lag cancer elimination by several months. In June 2022, the patient was confirmed to have no evidence of active disease.

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All treatments were discontinued, and she was considered to be in complete remission. Follow-up monitoring was scheduled every 3–6 months. Throughout her FBZ treatment, she continued her regular supplementation of vitamin D (5,000 IU) and a multivitamin. In July 2022, blood tests revealed elevated alanine aminotransferase and aspartate aminotransferase levels, suggesting potential liver dysfunction, though it remains unclear whether this was caused by fulvestrant, FBZ, or an interaction between the two. Liver function normalized within weeks, while CA 27.29 levels continued to decline to 37 (July 2022) and 26.5 (February 2023), both values within the normal range. Subsequent PET scans showed no abnormal metabolic activity. The FBZ treatment period revealed no adverse effects at this dosage. The patient remains recurrence-free and continues to take FBZ daily nearly 3 years after being declared to be in remission. A summary timeline is provided in Figure 1 below.

Case 2

A 75-year-old man was diagnosed in December 2021 with recurrent stage IV prostate cancer and extensive bone metastases. Initially diagnosed 10 years earlier and treated surgically, he had undetectable PSA levels for 18 months before a gradual rise indicated recurrence of prostate cancer. The diagnosis of metastatic cancer was confirmed through imaging studies and elevated PSA levels. Bone scans and CT revealed metastases in the spine, pelvic bones, and right humeral head, along with significant lymph node involvement. On a CT abdomen/pelvis with and without IV contrast performed on December 16, 2021, prominent left periaortic lymph nodes were identified, with a representative lymph node measuring 0.8 cm, which was not seen in previous studies.

In December 2021, the patient initiated androgen deprivation therapy with Orgovix and Erleada, complemented by Xgeva to support bone health. He also added repurposed medications and supplements: vitamin D (5,000–10,000 IU/day) with K2 and magnesium, melatonin (10–40 mg/day), berberine, curcumin, artemisinin, cimetidine, and other compounds with potential anticancer effects. He started taking FBZ in December 2021 (dose range: 222–444 mg/day), usually alternating with occasional dose reductions. In December 2022, after 1 year of follow-up, regression of bone lesions was observed, and lymph node involvement had fully resolved. In January 2024, after 2 years of follow-up, imaging confirmed significant regression of bone lesions with no new metastatic sites. The use of FBZ coincided with continued regression of metastatic lesions and sustained undetectable PSA levels. No increase in liver enzymes or any other side effects attributable to FBZ were reported. In April 2024, a PSMA PET/CT whole body scan revealed that the vast majority of the sclerotic bone lesions demonstrated no abnormal radiopharmaceutical accumulation. A large left renal cortical defect containing the kidney had a SUV of 0.5, and no abnormal radiopharmaceutical accumulation was observed within lymph nodes. PSA levels remained undetectable for over 2 years (<0.05 ng/mL). After 26 months of sustained regression and no new progression, the patient remains in near-complete response and continues FBZ with conventional therapy (androgen deprivation therapy with Xgeva). A summary timeline is provided in Figure 2 below.

Case 3

In July 2020, a 63-year-old man presented with a hip growth diagnosed as BRAFV600-mutated stage IIIC melanoma. He began 8 months of adjuvant dabrafenib and trametinib, stopped early (May 2021) due to decreased ejection fraction. After 1 year of treatment, the patient achieved remission, which lasted until 2023.

On December 12, 2023, however, a biopsy confirmed recurrence: a 1.6 mm ulcerated malignant melanoma located in the lower left abdomen (SOX-10 and pan-melanoma positive). PET-CT showed multiple hypermetabolic foci – peritoneal and retroperitoneal nodules, focal

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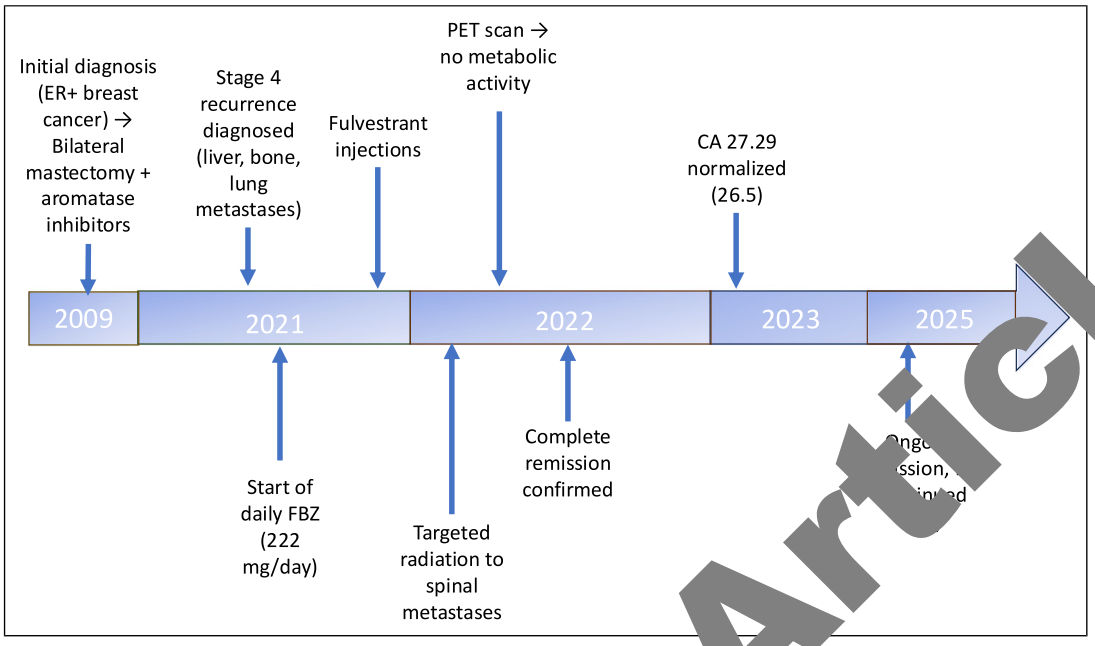

Fig. 1. Clinical and therapeutic timeline for case 1.

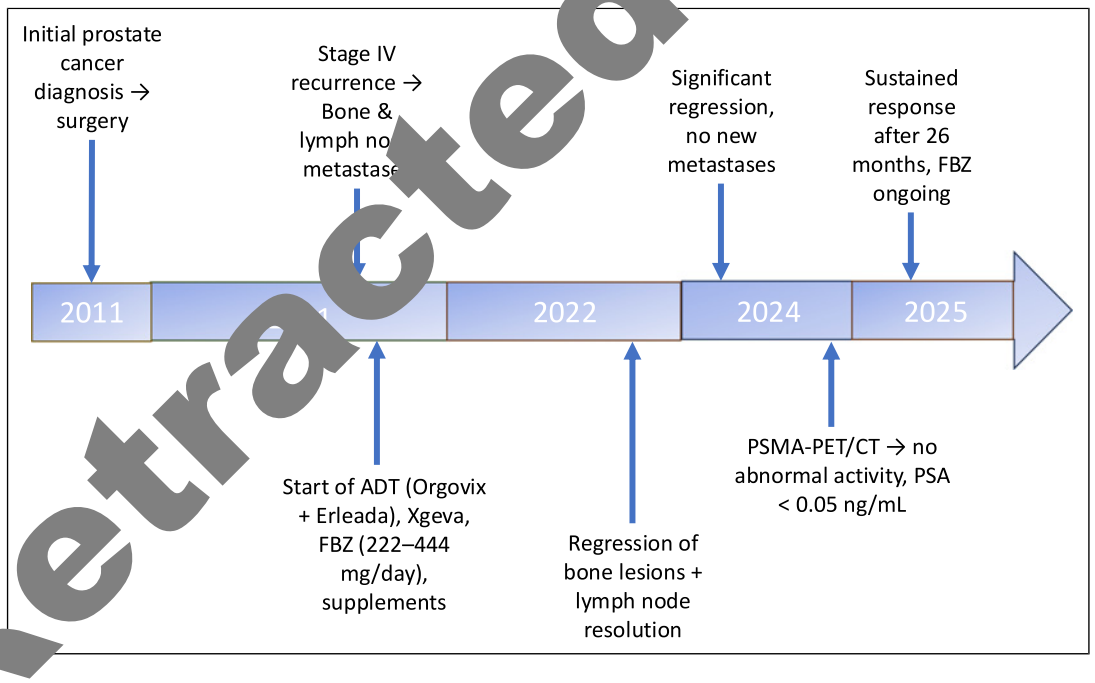

Fig. 2. Clinical and therapeutic timeline for case 2.

uptake in the stomach and small bowel, lesions in the right gluteus medius, quadratus femoris, and L5 vertebra. Incidental finding included mass-like distal ureter thickening which was confirmed on biopsy to be a different malignancy (urothelial carcinoma). Tempus xF (circulating tumor DNA) showed presence of BRAFV600 mutation, suggestive of the presence of recurrent melanoma. The patient's oncologist recommended delaying immunotherapy with

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nivolumab (Opdivo) after biopsy of the recurrent melanoma. During this treatment-free window, he began self-administering FBZ daily (dose range: 222 mg–444 mg) in mid-December 2023. The ureteral tumors disrupted urination, necessitating surgery in mid-December 2023. Blood tumor markers, measured as circulating tumor DNA, provided clear evidence of the melanoma progression and subsequent remission. On November 29, 2023, before initiating FBZ, the tumor marker with Signatera test was 123.37. By January 17, 2024, less than 7 weeks after starting the treatment, it dropped to 0.38 and reached 0 (zero) by February 21, 2024. During this period, the patient received two doses of nivoluma[illegible]. Remarkably, at the February 2024 follow-up, imaging and blood tests indicated "no evidence of disease" (NED). Supplements – including ascorbic acid (2,000 mg BID), cephalexin (500 mg single dose), cholecalciferol, CoQ10, cyanocobalamin, and glutathione – were taken throughout treatment and were part of the patient's regular routine before and after remission. The patient remains melanoma recurrence-free over 11 months after being declared to be in remission. A summary timeline is provided in Figure 3 below.

All detailed information and medical reports of the presented cases are provided in the online supplementary material to facilitate further review. Table 1 below provides a summary of the information for the 3 cases presented in this manuscript, including all therapies used, dosage, outcome, and follow-up duration.

Discussion

This report presents 3 cases where patients with advanced malignancy (breast, prostate, and melanoma, each at stage IV), achieved response after self-administering FBZ therapy. These cases raise intriguing possibilities regarding the potential of FBZ as an anticancer agent and underscore the need for further research into its clinical efficacy. To our knowledge, this is only the second case series documenting such outcomes after Stanford University Medical Center research group led by Chiang et al. [1] provided valuable insights into the potential repurposing of FBZ in cancer treatment. Unlike the Stanford University case series, the 3 cases presented here demonstrate outcomes of "no evidence of disease" (NED) sustained over months and even years. A recent case report documented the regression of stage IV diffuse large B-cell lymphoma after 12 months of treatment with FBZ at a dose of 1 g/day as monotherapy [5].

FBZ, a member of the benzimidazole class of drugs, exerts its anticancer effects through several mechanisms, including destabilization of microtubules, which induces mitotic arrest and promotes apoptosis in cancer cells – a process similar to that of vinca alkaloids. FBZ's antitumor properties are further attributed to its inhibition of proteasome activity, activation of p53, cytotoxicity through disruption of tubulin, and apoptosis. Apoptosis is induced by mitochondrial damage and is mediated through p53 expression [6]. Additionally, FBZ downregulates key metabolic pathways crucial for cancer cell survival. Beyond targeting primary cancer cells, benzimidazoles, including FBZ, have been shown to affect cancer stem cells [2, 3]. FBZ has already demonstrated safety and efficacy as an antiparasitic drug in veterinary medicine, making it a promising candidate for repurposing in human cancer treatment. While the doses used in this study were lower than those in the case series by Chiang et al. [1] (1 g/day, three times of week), FBZ still appears to be effective. These case reports provide additional evidence of tumor regressions or remissions potentially associated with FBZ use. They highlight improvements achieved without chemotherapy, and achieved concurrently with partial hormonal therapy, minimal immunotherapy, and secondary radiotherapy. Moreover, combined treatments with FBZ in the cases presented here generally do not lead to complete

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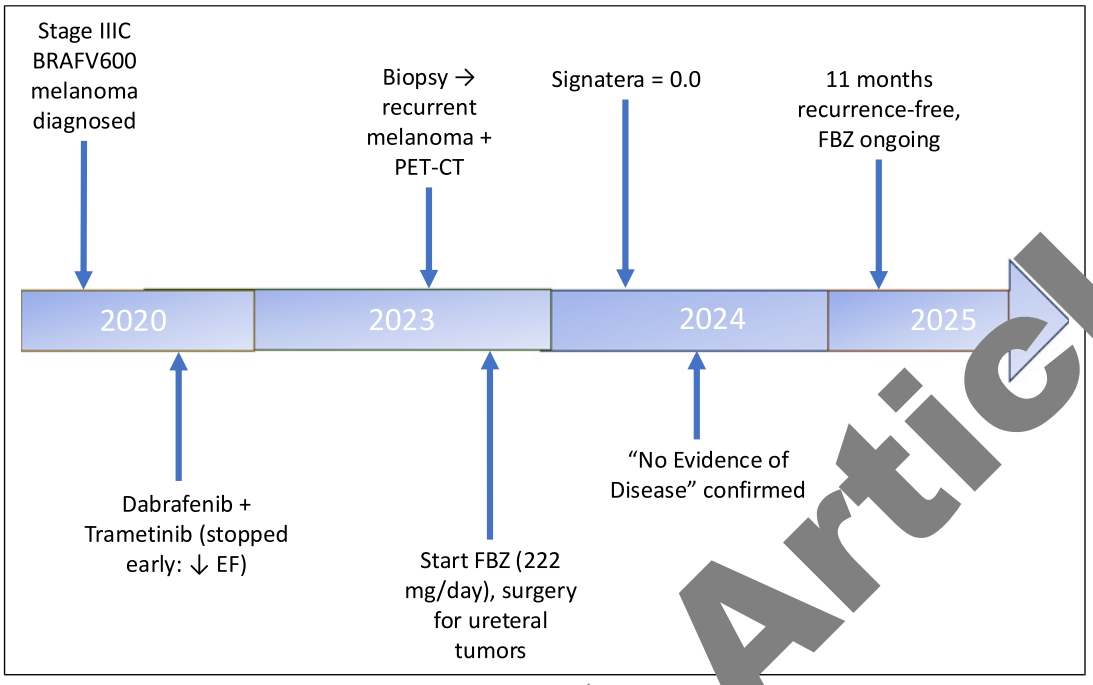

Fig. 3. Clinical and therapeutic timeline for case 3.

Table 1. Overview of three cases of advanced cancer wh nts took fenbendazole as part of their cancer management

Case, *n*	Cancer type	Treatment(s)	FBZ dose	Outcome	Follow-up duration
1	Stage IV breast	FBZ, fulves tr a iation, supp nts	222 mg/day	Complete remission	3 years
2	Stage IV prostate	FB DT, pplements	222–444 mg/day	Near-complete remission	26 months
3	Stage IV melanom	F surgery, supplements	222 mg/day	Complete remission	11 months

ADT, d oge privation therapy; FBZ, fenbendazole.

r i ic when used alone or in combination with other therapies [8, 9]. In other words, th dings are consistent with the anticancer activity of FBZ observed in in vitro and in vivo studies [10–12].

Nevertheless, the exact role of FBZ in these outcomes remains uncertain. These are anecdotal observations, and without controlled clinical trials, it is not possible to establish a causal relationship between FBZ and the observed disease regressions. Confounding factors such as concurrent therapies, lifestyle interventions, or spontaneous remission cannot be excluded. This study has several important limitations. First, the small sample size and retrospective nature prevent generalizability. Second, there is a significant risk of self-selection bias, as all patients initiated FBZ on their own. Third, combination with other treatments makes it difficult to isolate the effects of FBZ. It is important to emphasize that in all 3 cases, the decision to use FBZ was initiated independently by the patients, without

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medical recommendation or prescription. These individuals sought alternative options after exhausting or refusing standard therapies, which led them to explore anecdotal reports of FBZ. While physicians were aware of its clinical use in some instances, this self-medication occurred outside regulated clinical settings. These cases reflect a growing trend in patient-led repurposing of veterinary or off-label compounds, underscoring the urgent need for clinical trials and medical oversight to evaluate both safety and efficacy in such contexts. Fourth, the data are observational and lacks the methodological rigor of a controlled clinical trial. The rise of self-medication with unapproved compounds like FBZ is concerning. Without regulatory oversight, appropriate dosing, quality control, and safety monitoring are, suboptimal, inadequate, and potentially compromised. These risks highlight the urgent need for clinical trials, regulatory guidance, and education on the use of repurposed drugs in oncology. While these cases highlight the potential of FBZ as an antineoplastic agent, the risks of self-medication cannot be overlooked. Rigorous clinical studies are essential to establish its efficacy and safety, enabling the development of appropriate therapeutic protocols and ensuring its responsible use. In summary, while these cases offer a compelling rationale to further investigate FBZ, only well-designed clinical trials can confirm and support its potential as a safe and effective therapeutic option in oncology.

Conclusion

Despite the limited data and the relatively few studies on FBZ's anti-oncogenic properties in humans, this case series underscores the importance of further investigation into its potential application as a cancer treatment. The mechanisms by which benzimidazoles, including FBZ, work against cancer cells are well documented in preclinical models, but clinical evidence remains sparse. Given the promising results observed in these cases and the generally favorable safety profile of FBZ, future studies are warranted to assess its efficacy in larger cohorts and explore its potential for repurposing in the treatment of various malignancies. With its low cost and accessibility, FBZ represents a potentially valuable avenue for further exploration, either as a standalone treatment or in combination with traditional therapies, for patients with advanced cancers.

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Statement of Ethics

The case series data did not require ethical approval in accordance with local/national guidelines. Written informed consent was obtained from the patient for publication of this case report. Informed consent was obtained for this case series.

Conflict of Interest Statement

Authors state no conflict of interest.

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Author Contributions

W.M, I.B., and P.M. were responsible for reviewing and writing the final versi All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

All data generated or analyzed during this study are included in thi cle a ts online supplementary material. Further inquiries can be directed to the co esp ding author.

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