Case Report

A Review Leveraging a Rare and Unusual Case of Basal Cell Carcinoma of the Prostate

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Basal cell carcinoma (BCC) is a rare nonacinar variant of prostatic carcinoma. In spite of prostatic acinar adenocarcinoma being one of the most common carcinomas in prostate, <100 BCC of prostate have been described to date. Adenoid cystic/cribriform histology has been described in varying proportions to occur in prostatic BCC and is reported to be associated with aggressive behavior and high risk of metastasis. Herein, we present a case of prostatic BCC with adenoid cystic morphology, comprehensively describe its immunohistochemical and MYB/MYBL1 gene rearrangement findings, discuss its differential diagnosis, and review the literature of this rare entity.

1. Introduction

Basal cell carcinoma (BCC) is a rare malignant neoplasm of the prostate that is composed of prostate basal cells [1]. The first case of prostatic BCC was published in 1974 [2] and less than 100 BCC of prostate have been described to date [3–13]. Morphologically, it shares features to the cutaneous basal cell carcinoma and includes nests of basaloid cells with hyperchromatic nuclei and scant cytoplasm, tumor necrosis, and peripheral palisading. Prostatic BCC was initially referred to as adenoid cyst carcinoma (ACC) of the prostate due to the presence of cribriform pattern with intraluminal eosinophilic hyalinized substance and its resemblance to the salivary gland and breast counterparts [1]. In 2004, the World Health Organization (WHO) recognized ACC of the prostate as a spectrum of prostatic BCC [14]. Prostatic BCC without cribriform morphology can have overlapping features to a spectrum of benign entities in the prostate, such as florid basal cell hyperplasia [15]. For such morphologically challenging cases, immunohistochemical (IHC) stains including Bcl-2 and Ki-67 can aid in the diagnosis [16]. However, due to its rarity, genetic and molecular characteristics of prostatic BCC have not been extensively studied. Similar to the ACC of the salivary gland, recurrent t (6; 9) translocation, resulting in a fusion of MYB oncogene to the transcription factor gene NFIB, has been observed in a subset of prostatic BCC with ACC morphology [4]. Herein, we presented an unusual case of prostatic BCC with mixed ACC and non-ACC histologies and present its immunohistochemical profile and MYB rearrangement findings.

2. Case Presentation

A 92-year-old male with a past medical history of chronic heart failure and coronary artery disease presented with urethral stricture, concerning for urinary retention. He had a long urological history of membranous urethral stricture, and urinary retention which was managed by urethral dilations and green light laser prostatectomy since 2018. Cystoscopy was attempted but failed due to urethral stricture. CT imaging of the pelvic area revealed diffuse heterogeneous appearance of the prostate gland with suspicion for involvement of the bladder neck. The patient underwent transurethral resection of prostate (TURP) for both diagnostic and therapeutic purposes, and TURP specimen was sent to pathology. Post-TURP serum prostate-specific antigen (PSA) was within the normal range (<0.05 ng/mL).
On gross examination, the specimen consisted of multiple tan-pink rubbery cauterized tissue fragments, weighing 3 grams and measuring 5.8 × 2.3 × 0.2 cm in aggregate. Microscopically, the prostate chips showed variable sized medium to large irregular shaped basaloid nests (Figure 1(a)). Focal areas with peripheral palisading (Figure 1(b)), anastomosing nests (Figure 1(a)), and tubules with necrosis were seen (Figure 1(c)). Some of the nests were present in between benign prostate glands and focally extended between thick muscle bundles suggestive of invasion into the bladder neck (Figure 1(d)). Adenoid cystic-like pattern with cribriform architecture, intra-luminal eosinophilic, hyaline basement membrane-like material (Figure 1(e)), and perineural invasion (Figure 1(f)) was also present. The tumor cells had scant cytoplasm, irregular angulated nuclei with open chromatin, and high nuclear to cytoplasmic ratio. Focal stromal desmoplastic response was observed (Figure 1(a)). The tumor extensively involved 30% of the chips and focally spread to the overlying urothelium.

Immunohistochemically, the tumor revealed strong and diffuse reactivity for cytokeratin (CK) 7 and Bcl-2 (Figure 2(a)) and weak focal staining for GATA3. Variable multilayer reactivity for basal markers such as p63 and high molecular weight cytokeratin (HMWCK) was observed (Figure 2(b)). Ki-67 staining showed high proliferation (>30%, Figure 2(c)). The tumor was negative for CK20, NKX3.1 (Figure 2(d)), racemase (Figure 2(b)), synaptophysin, chromogranin, androgen receptor (AR), and HER2 (Table 1). These histopathologic and IHC features are compatible with the diagnosis of prostatic BCC.

**MYB** gene rearrangement by fluorescence in situ hybridization (FISH) using a break-apart probe was performed. In

![Figure 1](image1.png)
spite of a prominent ACC-like pattern, MYB break-apart was negative/not detected and all tumor cells have two fusion fluorescence signals (Figure 2(e)). Additional FISH studies using two fusion probes for MYB-NFIB and MYBL1-NFIB fusions also turned out to be negative.

Due to the patient’s age and systemic conditions, resection surgery was not deemed ideal, and the patient was treated with external beam radiotherapy to prevent morbidity from local disease progression and potentially to further relieve his urinary obstruction symptoms. The patient is currently alive 4 months post-diagnosis.

3. Discussion

We report a rare case of prostatic BCC and discuss the differential diagnosis and immunohistochemical profile that can help establish the correct diagnosis.

Prostatic BCC is composed of neoplastic prostatic basal cells unlike the more common variant of prostatic acinar adenocarcinoma that arises from the secretory epithelial cells of the prostate ducts and acini. The number of basal cells is significantly less compared to secretory cells in the prostate gland, perhaps explaining why prostatic BCC is rare with approximately 100 cases reported so far. Similar to our case, they have largely been reported in older men (42-93 years) [3, 8, 10, 17] with urinary obstruction symptoms. Since it is the secretory cells that contain and secrete prostate-specific antigen (PSA), the serum PSA levels in these patients are generally within normal range [3, 8, 18] unless there is concomitant acinar carcinoma which may be found in a minority of cases [3, 8, 10, 19]. The symptoms are therefore often misinterpreted to be due to benign prostate hyperplasia, and in the majority of the cases, the diagnosis is made on transurethral resection specimen [8, 9].
markers such as HMWCK (34βE12) and p63 [23] often label the outermost layers of BCC and may not stain the luminal cells (that may stain with cytokeratin 7) [8] (Table 2). It has been shown that in 60% (15/25) cases, multiple layers of cells (that may stain with cytokeratin 7) [8] (Table 2). It has been shown that in 60% (15/25) cases, multiple layers of cells express basal markers, while in 16% (4/25), only a few scattered positive cells are identified [3]. This could lead to misinterpretation in the diagnosis. The strong Bcl-2 expression and increased Ki-67 (often >20%) can help in distinguishing it from florid basal cell hyperplasia [16]. Negative staining for markers expressed in secretory cells such as PSA, prostatic specific acid phosphatase (PSAP), NKKX3.1, AMACR, androgen receptor (AR) [3, 17, 19], and ERG [19] can help differentiate it from prostatic acinar adenocarcinoma. Negative GATA3 can help exclude urothelial carcinoma and prostate adenocarcinoma [24]. Weak GATA3 staining has been reported in occasional benign prostatic basal cells [25]. In our case, the tumor cells also show weak positivity for GATA3. We are not aware of other studies that show a similar weak positivity pattern of GATA3 or lack of NKKX3.1 in prostatic BCC cases. Negative neuroendocrine markers help distinguish it from neuroendocrine carcinoma. HER2 expression may be variable in prostatic BCC and may provide a therapeutic opportunity [22, 26]. However, HER2 was negative in our case. Table 2 summarizes studies of the prostatic BCC and their morphologic and IHC results [2–13, 17, 20, 21, 27–45].

**MYB-NFIB** fusion has been recognized as a hallmark genetic driver for ACCs of various anatomic sites including salivary gland [46, 47], breast [48, 49], lacrimal gland [50], and skin [51]. Akin to ACC in the salivary glands, 17-47% of prostatic BCC have been shown to harbor the **MYB-NFIB** fusion [4, 9, 19, 52] by FISH techniques. The majority (57%) of these cases had ACC morphology. In contrast, only 93% of fusion negative cases had ACC features. **MYB** rearrangement using the break-apart probe was not detected in our case in spite of the presence of ACC morphology. The detection of the fusion may vary depending on the probe used. Using a break-apart probe, Bishop et al. detected **MYB** rearrangement in 29% (2/7) [4], while Magers et al. found fusions in 89% (8/9) using an **MYB-NFIB** fusion probe [9]. **MYBL1** variant has been reported to be an alternative genetic driver for ACC in the breast [53]. This discrepancy may also be the result of a small sample size. None of the cases with benign basal cell proliferations were found to have this fusion [9]. **TMPRSS2-ERG** fusions, which are seen in 50% of the prostatic adenocarcinoma, have not been reported in BCC [19]. In our case, neither **MYB** rearrangement nor **MYB1-NFIB** fusion is present.

BCC of the prostate is reported to be more aggressive than acinar adenocarcinomas. Extraprostatic extension at radical prostatectomy is reported in 44-71% [3, 9], distant metastasis in 14-29%, and disease associated died in 50% [3, 8, 10] of patients. The metastasis pattern is also different

### Table 1: Immunohistochemical antibody information.

| Antibody       | Source       | Dilution | Immunoreactivity |
|----------------|--------------|----------|------------------|
| p16            | VENTANA      | PD*      | Positive         |
| NKKX3.1        | CELL MARQUE  | PD       | Negative         |
| CK7            | VENTANA      | PD       | Positive         |
| CK20           | VENTANA      | PD       | Negative         |
| Synaptophysin  | VENTANA      | PD       | Negative         |
| Chromogranin   | VENTANA      | 1 : 2    | Negative         |
| HMWCK          | VENTANA      | PD       | Positive         |
| p63            | VENTANA      | PD       | Positive         |
| Racemase       | ZETA CORP    | 1 : 200  | Negative         |
| Gata3          | CELL MARQUE  | PD       | Weakly positive  |
| Androgen receptor | VENTANA  | PD       | Negative         |
| HER2           | VENTANA      | PD       | Negative         |
| Bcl-2          | VENTANA      | PD       | Positive         |
| Ki-67          | VENTANA      | PD       | >30%             |

*PD: prediluted (ready to use).*
Table 2: A summary of prostatic BCC studies (empty cells: no information was available).

| Year  | Study          | Sample size | ACC-like pattern | Desmo-plasia | Morphology | CK7 (+) | CK20 (+) | HMWCK (+) | p63 (+) | Race-mase (+) | NKX3.1 (+) | PSA (+) | PSAP (+) | Bcl-2 (+) | Ki-67 >20% | MYB rearrangement | MYB-NFIB fusion |
|-------|----------------|-------------|------------------|--------------|------------|---------|----------|-----------|--------|----------------|------------|---------|---------|-----------|------------|-------------------|-----------------|
| 1975  | Tannerbaum [12] | 2           | 100%             |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1984  | Reed [11]      | 4           | 100%             |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1988  | Young [13]     | 2           | 100%             |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1988  | Grignon [7]    | 2           | 100%             | 50%          | 100%       | 0%      | 0%       |           |        |                |            |         |         |           |            |                   |                 |
| 1993  | Devaraj [6]    | 4           | 100%             | 25%          | 100%       |         |          |           |        |                |            | 50%     | 50%     |           |            |                   |                 |
| 2003  | Iczkowski [8]  | 19          | 63%              | 26%          | 100%       | 0%      | 86%      | 0%        |        |                |            | 20%     | 13%     |           |            |                   |                 |
| 2004  | McKenny [10]   | 4           | 75%              | 0%           | 100%       | 75%     | 75%      |           |        |                |            | 92%     | 57%     |           |            |                   |                 |
| 2007  | Ali [3]        | 29          | 64%              | 71%          | 14%        | 100%    | 27%      | 100%      | 92%    | 57%            |            |         |         |           |            |                   |                 |
| 2013  | Chang [5]      | 3           | 0%               |              |           |         | 100%     | 100%      |        |                |            | 100%    | 100%    |           |            |                   |                 |
| 2015  | Bishop [4]     | 12          | 58%              |              |            |         |          |           |        |                |            | 17%     |         |           |            |                   |                 |
| 2019  | Magers [9]     | 30          | 64%              | 14%          | 64%        |         |          |           |        |                |            |         |         |           |            |                   |                 |

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| Year  | Study          | Sample size | ACC-like pattern | Desmo-plasia | Morphology | CK7 (+) | CK20 (+) | HMWCK (+) | p63 (+) | Race-mase (+) | NKX3.1 (+) | PSA (+) | PSAP (+) | Bcl-2 (+) | Ki-67 >20% | MYB rearrangement | MYB-NFIB fusion |
|-------|----------------|-------------|------------------|--------------|------------|---------|----------|-----------|--------|----------------|------------|---------|---------|-----------|------------|-------------------|-----------------|
| 1974  | Frankel [2]    | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1978  | Kramer [35]    | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1984  | Kuhajda [36]   | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1984  | Chan [29]      | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1986  | Gilmour [31]   | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1991  | Ahn [27]       | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1992  | Denholm [21]   | 1           | -                | -            | -          | +       |          |           |        |                |            |         |         |           |            |                   |                 |
| 1993  | Cohen [20]     | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 1996  | Hasan [32]     | 1           | -                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 2001  | Minder [38]    | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 2002  | Schmid [41]    | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 2003  | Mastropasqua [37] | 1      | -                | +            | -          | -       | +        |           |        |                |            |         |         |           |            |                   |                 |
| 2004  | Parada [39]    | 1           | -                | +            |            | +       |          |           |        |                |            |         |         |           |            |                   |                 |
| 2004  | Tulunay [45]   | 1           | +                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 2006  | Fayad [30]     | 1           | +                |              | +          | -       | +        |           |        |                |            |         |         |           |            |                   |                 |
| 2008  | Hudson [33]    | 1           | +                |              | +          | +       |          |           |        |                |            |         |         |           |            |                   |                 |
| 2008  | Segawa [42]    | 1           | -                | -            | -          | +       | +        |           |        |                |            |         |         |           |            |                   |                 |
| 2010  | Bohn [28]      | 1           | +                |              | +          | -       | +        |           |        |                |            |         |         |           |            |                   |                 |
| 2010  | Komura [34]    | 1           | -                | +            | -          | +       |          |           |        |                |            |         |         |           |            |                   |                 |
| 2012  | Stearns [43]   | 1           | -                |              |            |         |          |           |        |                |            |         |         |           |            |                   |                 |
| 2013  | Rodriguez-Carlin [40] | 1  | +                |              | +          | +       |          |           |        |                |            |         |         |           |            |                   |                 |
Table 2: Continued.

| Year | Study             | Sample size | ACC-like pattern | Desmo-plasia | PNI | CK7 (+) | CK20 (+) | HMWCK (+) | p63 (+) | Bcl-2  | Ki-67 >20% | MYB rearrangement | MYB-NFIB fusion |
|------|-------------------|--------------|------------------|--------------|-----|---------|----------|-----------|---------|--------|------------|-------------------|------------------|
| 2014 | Tsuruta [44]      | 1            | –                | +            | +    | +       | +        |           |         |        | –          | 10%               |                  |
| 2019 | Shibuya [17]      | 1            | –                | –            | +    |          |          |           |         | –      | –          | –                 |                  |
|      | Current case report| 1            | +                | +            | +    | –       | +        | –         | –       | –      | 30%        | –                 | –                |

* Some of these case series may have overlapped cases.
from the traditional prostatic adenocarcinoma. Prostatic BCC tends to metastasize to the liver and lung, though bone metastasis has also been reported [5, 8]. Ablative therapy is recommended [5, 8] for these patients.

In summary, prostatic BCC can be challenging to diagnose. Better awareness of this entity, establishing basal cell immunophenotype, and identification of malignant features such as cytologic atypia, unequivocal invasion, perineural invasion, necrosis, or extraprostatic extension can aid in making the correct diagnosis.

Conflicts of Interest
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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