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# Hypofractionated image-guided radiotherapy with 70 Gy in 28 fractions for prostate cancer confined to the pelvis: a single institute experience in Taiwan

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## Abstract

**Background** The incidence of prostate cancer is increasing in Asian countries. Although moderately hypofractionated radiotherapy is not inferior to conventional fractionated radiation according to the updated guidelines, data regarding its efficacy and safety in Taiwan are currently lacking. The aim of this study was to investigate the outcomes of prostate cancer patients treated with hypofractionated image-guided radiotherapy at a single institution in Taiwan.

**Methods** We retrospectively included patients with prostate cancer across all risk groups who were treated with hypofractionated image-guided radiotherapy 70 Gy (Gy) in 28 fractions (at 2.5 Gy/fraction) between 2007 and 2022. We analyzed treatment efficacy by assessing overall survival, prostate cancer-specific survival, event-free survival, biochemical failure, locoregional recurrence, and distant metastasis. The safety of the treatment was evaluated through acute and late gastrointestinal (GI) and genitourinary (GU) toxicity grading based on the Radiation Therapy Oncology Group criteria. Event-free survival, overall survival, prostate cancer-specific survival, biochemical failure, locoregional recurrence, and distant metastasis were evaluated using the Kaplan–Meier method.

**Results** We identified 150 consecutive men with prostate cancer: 12.7% were at low risk, 32.7% were at intermediate risk, 44.6% were at high risk, and 10% had N1 disease. The median follow-up time was 68.9 months (range: 2.3–172 months). The 5-year overall survival rate was 91.7% for the entire cohort, with rates of 100%, 94.3%, 93.3% and 71.1% for the low-risk, intermediate-risk, high-risk, and N1-disease groups, respectively ($p < 0.001$). The 5-year event-free survival rate for all patients was 75.8%. Among the risk groups, the 5-year event-free survival rates were 100%, 86.3%, 68.3% and 52.5% for the low-risk, intermediate-risk, high-risk, and N1 disease groups, respectively ($p < 0.001$). Grade ≥ 2 late GI toxicity was rare (0.7%), and grade ≥ 2 late GU toxicity was observed in 9.3% of the patients.

**Conclusions** Hypofractionated image-guided radiotherapy, delivering 70 Gy at 2.5 Gy per fraction, is both effective and safe for Taiwanese patients with prostate cancer across all risk groups, consistent with findings from existing

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large randomized trials. Therefore, as a solution to enhance patient convenience, hypofractionated radiotherapy is a reasonable option for the definitive treatment of prostate cancer.

**Trial registration** Not applicable.

**Keywords** Prostate cancer, Hypofractionation, Image-guided radiotherapy, Treatment toxicities

## Background

Prostate cancer is the second most common cancer and one of the leading causes of cancer-related mortality in men worldwide [1]. There are various treatment modalities for prostate cancer, including active surveillance, surgery, radiation therapy, and androgen deprivation therapy (ADT). Radiation therapy with different fractionation schedules and dose levels can be considered based on individual clinical presentations. Dose escalation with conventional fractionated radiation therapy using 1.8–2 Gy (Gy) per fraction for total doses up to 78–80 Gy has demonstrated superior biochemical control [2–4].

The estimated α/β value for prostate cancer is 1.5 Gy, which is lower than that of late-responding normal tissues such as the rectum and bladder, with reported α/β estimates of 3–5 Gy [5, 6]. This indicates that prostate cancer cells are more sensitive to larger fraction sizes in comparison to the surrounding normal tissues. Exploiting this advantage of the α/β ratio, hypofractionated radiation regimens with fewer large dose fractions have the potential to provide therapeutic benefits for the treatment of prostate cancer. Furthermore, shorter treatment durations are more convenient for patients and reduce the economic burden.

Several randomized studies have demonstrated the noninferiority of hypofractionation to conventional regimens [7–10]. However, conflicting data exist regarding late gastrointestinal (GI) and genitourinary (GU) toxicity caused by hypofractionation [11, 12]. Although much of the current understanding of prostate cancer is derived from research on Western populations, there is notable heterogeneity in disease characteristics and biology between Eastern and Western patients [13]. There is currently a paucity of data regarding the outcomes of moderately hypofractionated radiation therapy for prostate cancer patients among Taiwanese men. This study sought to assess the efficacy and adverse effects of our single-institution cohort of patients with prostate cancer treated with definitive moderately hypofractionated image-guided radiotherapy.

## Methods

We retrospectively included patients with prostate cancer across all risk groups who underwent moderately hypofractionated radiation therapy from January 2007 to December 2022. The regimen of moderately hypofractionated radiation was 70 Gy in 28 fractions (at 2.5-Gy per fraction) for all patients. The inclusion criteria included individuals with histologically confirmed adenocarcinoma of the prostate, staged cT1-4N0-1M0 in accordance with the American Joint Committee on Cancer guidelines, regardless of Gleason score and prostate-specific antigen (PSA) level. Risk groups were defined according to NCCN guidelines. Patients with localized prostate cancer without nodal involvement were stratified into low-risk, intermediate-risk, and high-risk groups. Patients with regional nodal metastasis were classified into the N1 disease group.

Pretreatment assessment consisted of complete medical history, digital rectal examination, PSA level, pelvic magnetic resonance imaging (MRI), and bone scan. Patients were followed up at the outpatient department with regular monitoring of PSA levels every three to six months. Biochemical failure was defined as an increase in the PSA level of 2 ng/mL from the nadir. In patients with biochemical failure, MRI and bone scans were performed to evaluate possible local and distant recurrence. Symptoms were reported by physicians and graded according to the Radiation Therapy Oncology Group criteria. Acute toxicity was defined as adverse effects that developed within three months after the completion of radiotherapy, and late toxicity was defined as adverse effects three months or more after the completion of radiotherapy.

### Radiotherapy

A bowel and bladder preparation protocol was strictly implemented for the planning and treatment of patients. All patients were instructed to empty the bladder and rectum and for a relatively stable full bladder to drink 500 ml of water 20 min before the computed tomography (CT) simulation and each treatment fraction.

All patients received radiotherapy in the supine position and were immobilized with a thermoplastic cast with their arms resting on the chest. CT images were obtained from 5 cm superior to the L4 vertebra to 5 cm inferior to the ischial tuberosity with a 5 mm slice thickness.

Treatment planning and delivery of 70 Gy to the prostate and seminal vesicles (2.5 Gy per fraction) were performed using Tomotherapy (Accuray, Inc., Sunnyvale, CA, USA). Elective nodal irradiation with 47.6 Gy in 28 fractions was performed for pelvic lymph nodes with an involvement probability ≥ 15%, which was calculated according to Roach's formula (LN%=(2/3) PSA+(Gleason – 6)×10) [14]. For N1 disease, regional

nodal metastasis was irradiated at a dose of 56 Gy in 28 fractions. Image guidance was performed using megavoltage computed tomography (MVCT) throughout the entire treatment course.

Clinical target volume (CTV) was divided into CTV1 and CTV2. The whole prostate was delineated as CTV1, with the whole seminal vesicle included in the CTV1 for patients with seminal vesicle invasion, and only the proximal seminal vesicle was included if no invasion was present. CTV2 included the pelvic lymph nodes. For N1 patients, pelvic lymphadenopathy detected on CT or MRI was delineated as the gross tumor volume (GTV). To create the planning target volume (PTV), margins of 5 mm were added to the GTV and CTV in all directions, except for 3 mm posteriorly in CTV1. This decision was based on the strict implementation of image guidance and bowel and bladder preparation throughout the entire radiotherapy course. At least 95% of the PTV was required to receive the prescription dose. The dose–volume constraints for organs at risk were as follows: femoral head, Dmax < 50 Gy; bladder, V70 < 35%; V65 < 50%; rectum, V70 < 25%; and V65 < 35%.

**Table 1** Baseline characteristics

| Characteristic | Number of patients |
|---|---|
| **Age (years)** | |
| Median (range) | 71 (53–91) |
| **PSA (ng/mL)** | |
| < 10 | 54 (36%) |
| ≥ 10 to < 20 | 47 (31.3%) |
| ≥ 20 | 49 (32.7%) |
| **Gleason Score** | |
| ≤ 6 | 51 (34%) |
| 7 | 42 (28%) |
| 8 to 10 | 53 (35.3%) |
| **Clinical T stage** | |
| T1 | 27 (18%) |
| T2 | 80 (53.3%) |
| T3 | 39 (26%) |
| T4 | 4 (2.7%) |
| **Lymph node metastasis** | |
| N0 | 135 (90%) |
| N1 | 15 (10%) |
| **NCCN Risk Group** | |
| Low risk | 19 (12.7%) |
| Intermediate risk | 49 (32.7%) |
| High risk | 67 (44.6%) |
| N1 disease | 15 (10%) |
| **Hormonal therapy** | |
| Yes | 149 (99.3%) |
| No | 1 (0.7%) |
| **Follow-up time (months)** | |
| Median (range) | 68.9(2.3–172) |

PSA: Prostate-specific antigen

### Androgen deprivation therapy

According to our practice guideline, short-term, long-term, or life-long ADT is recommended for patients with intermediate-risk, high-risk or N1 disease, respectively. The actual duration of ADT was determined at the discretion of the treating physicians and patient tolerability. The median duration of androgen suppression was 3 months (range: 1–23 months) for intermediate-risk patients, 5 months (range: 1–44 months) for high-risk patients, and 23 months (range: 1-100 months) for those classified as having N1 disease.

### Statistical analysis

We analyzed treatment efficacy by assessing overall survival, prostate cancer-specific survival, event-free survival, biochemical failure, locoregional recurrence, and distant metastasis. Biochemical failure was defined as a PSA increase of ≥ 2 ng/ml above the PSA nadir according to the RTOG Phoenix definition. Event-free survival was defined as the time until biochemical failure, local recurrence, distant metastasis, or death, whichever occurred first. Event rates for these outcomes were estimated using the Kaplan-Meier method. Comparisons of event rates among different risk groups were performed using the log rank test. A p value threshold of < 0.05 was set for statistical significance to determine differences in outcomes between the risk groups. We evaluated treatment safety by evaluating the occurrence of acute and late GI and GU toxicity, graded according to the RTOG grading system.

## Results

### Patient and treatment characteristics

A total of 150 consecutive men with localized prostate cancer were included in this retrospective analysis. Baseline characteristics are shown in Table 1. The median patient age was 71 years (range 53–91 years). Based on NCCN risk groups, 19 patients (12.7%) had low-risk disease, 49 (32.7%) had intermediate-risk disease, 67 (44.6%) had high-risk disease, and 15 (10%) had N1 disease. Pretreatment PSA) was > 10 ng/mL in 96 patients (64%). Fifty-three patients (35.3%) had Gleason score 8–10 disease. Clinical T3-T4 stage disease was present in 43 patients (28.7%), and pelvic nodal metastases were present in 15 patients (10%) at initial diagnosis.

### Clinical outcomes

The median follow-up time was 68.9 months (range: 2.3–172 months). All patients completed the treatment course without interruption. The 5-year overall survival rate was 91.7% for the entire cohort (Fig. 1A). When stratified by risk group, the 5-year overall survival rates were 100% for low-risk patients, 94.3% for intermediate-risk patients, 93.3% for high-risk patients, and 71.1% for N1 disease patients (Fig. 1B). The 5-year prostate cancer-specific

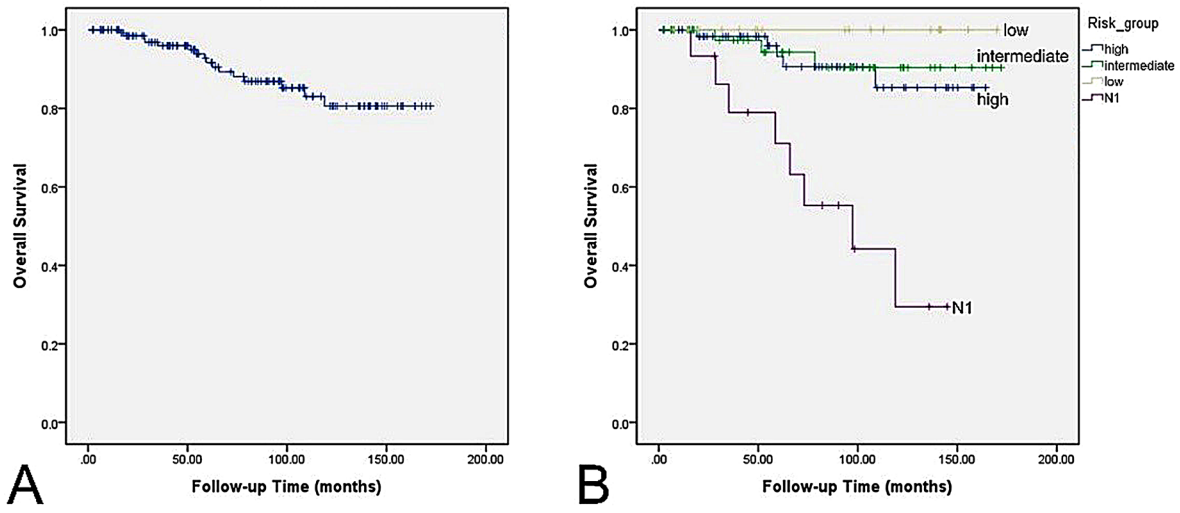


**Fig. 1** Kaplan-Meier curves showing overall survival. (**A**) All patients. (**B**) Different risk groups

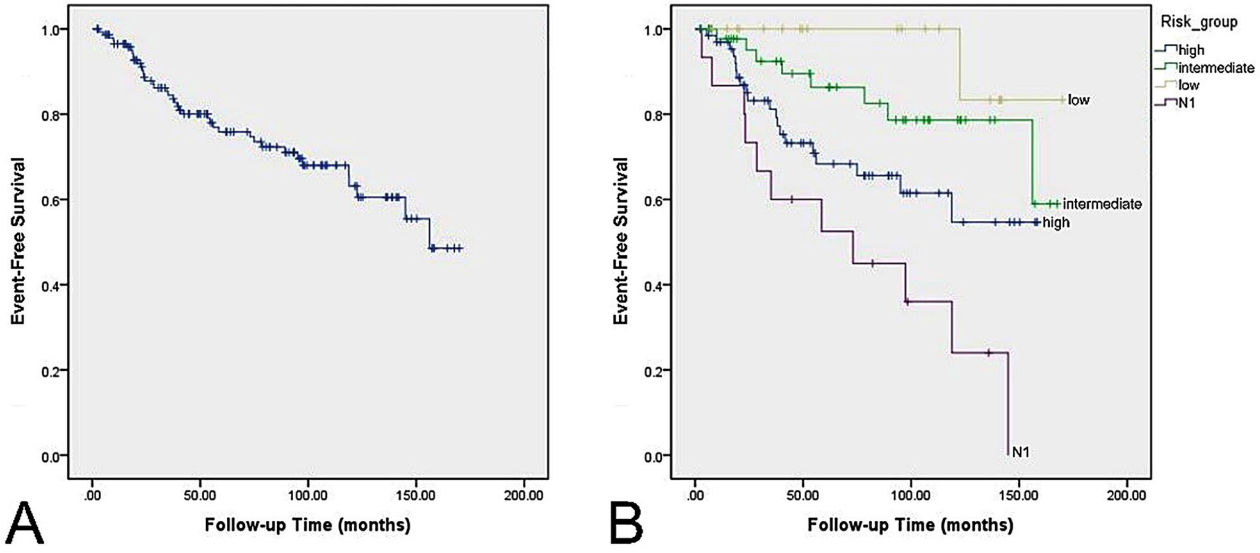


**Fig. 2** Kaplan-Meier curves showing event-free survival. (**A**) All patients. (**B**) Different risk groups

survival rates were 100% for low-risk, 96.9% for intermediate-risk, 97.1% for high-risk, and 93.3% for N1 patients. Of the 16 recorded deaths, 5 were directly attributable to prostate cancer. The remaining 11 deaths were due to other causes, including bladder cancer, heart disease, gastrointestinal ulcer bleeding with hemorrhagic shock, and pneumonia. Non-prostate cancer-related mortality accounted for a substantial portion of death events in our N1 patients.

The 5-year event-free survival rate was 75.8% for all patients (Fig. 2A). By risk category, the rates were 100% for low-risk patients, 86.3% for intermediate-risk patients, 68.3% for high-risk patients, and 52.5% for N1 disease patients (Fig. 2B).

The 5-year biochemical failure rate was 15.9% overall, with rates of 0% for low-risk, 11.2% for intermediate-risk, 24.5% for high-risk, and 13.3% for N1 disease. The 5-year locoregional recurrence rate was 7% across the entire cohort; stratified by risk, the rates were 0% for low-risk patients, 8.1% for intermediate-risk patients, 8.4% for high-risk patients and 6.7% for N1 disease patients. The 5-year distant metastasis rate was 12.2% overall; when categorized by risk group, the rates were 0% for low-risk patients, 5.7% for intermediate-risk patients, 18.1% for high-risk patients, and 20.0% for N1 disease patients. For intermediate- to high-risk localized prostate cancer patients, the 5-year overall survival rate was 93.7%, while the 5-year biochemical failure rate was 19%.

**Table 2** Acute and late genitourinary and gastrointestinal toxicity (no.[%])

| Grade | Acute Toxicity | | Late Toxicity | |
|---|---|---|---|---|
| | GU | GI | GU | GI |
| 0 | 82 (54.7) | 129 (86) | 109 (72.7) | 146 (97.3) |
| 1 | 47 (31.3) | 17 (11.3) | 27 (18) | 3 (2) |
| 2 | 21 (14) | 3 (2) | 14 (9.3) | 1(0.7) |
| 3 | 0 (0) | 1 (0.7) | 0 (0) | 0 (0) |
| 4 | 0 (0) | 0 (0) | 0 (0) | 0 (0) |

GI: Gastrointestinal, GU: Genitourinary

Among 67 high-risk prostate cancer patients, 49 (73%) underwent whole-pelvic radiotherapy (WPRT), while 18 (27%) received prostate-only radiotherapy (PORT). The 5-year overall survival rate was 96.6% for the WPRT group compared to 85.9% for the PORT group ($p = 0.136$). The 5-year event-free survival rates were 68.6% and 66.7% for WPRT and PORT, respectively ($p = 0.460$). The 5-year loco-regional recurrence rates were 10% for WPRT and 5.6% for PORT ($p = 0.849$), with only one case of pelvic nodal recurrence observed in the PORT group. The 5-year distant metastasis rates were 16.1% for WPRT and 23% for PORT ($p = 0.544$). None of the observed differences reached statistical significance.

### Toxicities

Treatment was well tolerated overall, as shown in Table 2. A total of 54.7% of patients finished treatment without any acute GU toxicity. Acute grade 1 GU toxicity occurred in 31.3% of patients, and grade 2 GU toxicity occurred in 14.0%; the most frequent symptoms were nocturia, dysuria, frequency and urgency. No acute GU toxicity exceeded grade 3. Similarly, late GU toxicity was mild, with 18.0% of patients experiencing grade 1 and 9.3% experiencing grade 2 events.

Acute GI toxicity also showed a favorable profile, with 86.0% of patients having no symptoms and 11.3% having grade 1 toxicity. One patient (0.7%) had grade 3 diarrhea. Late GI toxicity was rare, with only four patients (2.7%) developing grade ≤ 2 toxicity. In summary, grade ≥ 3 acute events were rare (0.7% GI only), and no late grade 3 or higher toxicity was observed. The safety profile indicated that patients tolerated treatment well overall, with no excessive or severe acute toxicity and minimal late side effects. This favorable toxicity contributes to the feasibility of this approach for prostate cancer treatment.

## Discussion

Several randomized studies and meta-analysis have demonstrated the noninferiority of hypofractionated radiation therapy compared to conventional fractionation in patients with prostate cancer [7–10, 15]. While most of the earlier trials evaluated only low-risk patients, recent studies, including the Fox Chase trial [16], HYPRO trial [10], and the study from Arcangeli et al. [15], have enrolled patients with intermediate- to high-risk disease and demonstrated favorable outcomes. Based on this evidence, the option of hypofractionation should be provided for all risk groups of patients with prostate cancer who are suitable for external beam radiation therapy. However, there are a variety of combinations of total dose and fraction size, and the optimal regimen has yet to be determined.

In an early study by Kupelian et al. [17], the biochemical relapse-free survival rate and toxicity were investigated in patients with localized prostate cancer across all risk groups treated with 70 Gy delivered at 2.5 Gy per fraction over 5 weeks. With a median follow-up of 45 months (maximum, 86), the overall 5-year biochemical relapse-free survival rate, defined as PSA nadir + 2 ng/mL, was 83% (95% confidence interval, 79–86%). Specifically, for patients with low-risk, intermediate-risk, and high-risk disease, the rates were 94%, 83%, and 72%, respectively. Lee et al. [9] compared hypofractionated radiation therapy (70 Gy in 28 fractions) with conventional radiation therapy (73.8 Gy in 41 fractions) in low-risk patients. There was no significant difference in 5-year disease-free survival (86.3% vs. 85.3%) or biochemical failure (6.3% vs. 8.1%) between the two arms. In our study, excellent disease control was also achieved in all risk groups. Our 5-year event-free survival rate, with the same definition as disease-free survival reported in the study published by Lee et al., was 100%, 86.3% and 68.3% for patients with low-risk, intermediate-risk, and high-risk disease, respectively.

In the HYPRO trial [10], 804 patients with intermediate- to high-risk localized prostate cancer were randomly assigned to either the hypofractionation (64.6 Gy in 19 fractions, 3 fractions per week) or standard fractionation (78 Gy in 39 fractions, 5 fractions per week) group. The 5-year relapse rates were 19.5% and 22.9% for the hypofractionated arm and the conventional arm, respectively, and biochemical failure accounted for approximately 90% of the first relapse events. The 5-year overall survival rates were 86.2% and 85.9% for the hypofractionated arm and the conventional arm, respectively. In our study, a majority of our patients had intermediate- to high-risk localized prostate cancer, and the 5-year biochemical failure rate for these patients was 19%, which was comparable with the results of the HYPRO trial. Our 5-year overall survival rate for these patients was 93.7%. These outcomes corroborate the existing evidence that optimal disease control for intermediate- to high-risk localized prostate cancer could be achieved with a hypofractionated regimen.

A meta-analysis of elective pelvic nodal irradiation using moderate hypofractionation for high-risk prostate cancer [18] reported a 5-year biochemical relapse-free survival of 90%, disease-free survival of 88.7%, and low

rates of local (0.38%), pelvic (0.13%), and distant (7.35%) recurrence. In comparison, our study observed a 5-year overall survival rate of 93.3%, event-free survival of 68.3%, with a biochemical failure rate of 24.5%, loco-regional recurrence at 8.4%, and distant metastasis at 18.1%. We investigated whether omitting pelvic radiotherapy in a subset of high-risk prostate cancer patients affected oncological outcomes, as these patients might benefit from whole-pelvic radiotherapy due to the increased likelihood of micrometastatic disease in the pelvic lymph nodes. Among 67 high-risk patients, 49 (73%) received whole-pelvic radiotherapy, while 18 (27%) underwent prostate-only radiotherapy. The 5-year OS rate was 96.6% for WPRT and 85.9% for PORT ($p = 0.136$). Although the WPRT group showed numerically higher OS, the difference was not statistically significant. The 5-year event-free survival rates were similar, at 68.6% for WPRT and 66.7% for PORT ($p = 0.460$). Loco-regional recurrence rates at 5 years were low in both groups: 10% for WPRT and 5.6% for PORT ($p = 0.849$), with only one case of pelvic nodal recurrence observed in the PORT group. The 5-year distant metastasis rates were 16.1% for WPRT and 23% for PORT ($p = 0.544$), showing a higher rate in the PORT group, but without statistical significance. Due to the small number of cases and events, subgroup analysis remains challenging and requires cautious interpretation. Larger-scale studies are necessary to clarify the role of elective pelvic nodal irradiation in high-risk prostate cancer patients treated with moderate hypofractionated radiotherapy.

The overall survival of node-positive prostate cancer is relatively poor. There is limited evidence regarding the benefit of radiation therapy in patients with node-positive prostate cancer who are traditionally treated with ADT alone. Nonetheless, in the subgroup of patients with nodal disease from the STAMPEDE trial [19], the 2-year failure-free survival in those treated with a conventional radiation schedule (74 Gy in 37 fractions) was significantly better than that in those who did not receive radiation therapy: 81% (95% CI, 71-87%) vs. 53% (95% CI, 40-65%), respectively. Additionally, according to RTOG 8531 [20], the 5-year absolute survival rate was 72%, and the progression-free survival rate was 54% for patients with nodal disease treated with conventional RT (65–70 Gy at a fraction size of 1.8–2 Gy) plus immediate ADT. A retrospective study involving 97 patients treated with definitive IMRT and ADT for clinically node-positive prostate cancer [21] reported favorable 5-year outcomes, with relapse-free survival at 88.1% and overall survival at 92.7%, and minimal toxicity. In comparison, our smaller study of 15 node-positive patients showed lower 5-year overall survival (71.1%) and event-free survival (52.5%). The differences in outcomes between the two studies could be attributed to several factors. Sample size plays a key role, with larger studies often producing more reliable data. In terms of dose-response, our study administered slightly lower doses to the elective nodes (47.6 Gy vs. 54 Gy), which may have affected disease control, especially in lymph node-positive cases. Additionally, patient selection and treatment protocols—including the duration of androgen deprivation therapy, baseline health, and tumor burden—can influence relapse-free and overall survival rates.

Prior reports of hypofractionated regimens have demonstrated varying rates of GI and GU toxicity. In the study by Lee et al. [9], late grade 2 GI (18.3% vs. 11.4%, $p = 0.002$) and GU toxicity (26.2% vs. 20.5%, $p = 0.009$) were more frequently observed in the hypofractionated arm than in the conventional fractionated arm. A greater incidence of grade ≥ 2 late GI (21.9% vs. 17.7%) and GU (late 41.3% vs. 39.0%) toxicity was also observed in patients receiving hypofractionated radiation therapy than in those receiving conventional fractionated therapy in the HYPRO trial [12]. However, the results from certain prospective noninferiority trials, including the PROFIT [8] and CHHiP [7] studies, demonstrated comparable rates of late GI and GU toxicity between hypofractionated radiotherapy and conventional fractionation schemes. In the PROFIT study [8], grade ≥ 2 late GI and GU toxicity developed in 8.9% and 22.2% of prostate cancer patients, respectively, after delivery of hypofractionated radiation therapy to a total dose of 60 Gy at 3 Gy per fraction size. Additionally, findings from the CHHiP trial [7] revealed rates of grade ≥ 2 late GI and GU toxicity of 11.9% and 11.7%, respectively, in the patient subgroup randomized to the hypofractionated treatment arm receiving 60 Gy in 20 fractions. Our study supports the safety of hypofractionation, as only a few incidences of late GI and GU toxicity of grade ≥ 2 (0.7% and 9.3%, respectively) were observed during a median follow-up of 5 years.

The observed difference in toxicity incidence may be partially explained by the higher effective dose (BED = 211.03 Gy; EQD2 = 90.44 Gy) in the hypofractionated regimen employed in the HYPRO trial than in our study (BED = 186.67 Gy; EQD2 = 80.00 Gy), assuming an $\alpha/\beta$ ratio of 1.5 Gy for prostate cancer. Notably, the BED associated with the hypofractionated regimen in the PROFIT and CHHiP trials was lower, at 180.00 Gy (EQD2 = 77.14 Gy). Consequently, given the generally favorable long-term survival rates in prostate cancer patients, when selecting a radiation regimen, factors such as patient preference, baseline condition, and potential toxicity should be weighed alongside tumor control rates.

Additionally, radiation delivery techniques can impact toxicity rates. In our study, all patients received Tomotherapy with leading intensity modulation and built-in image guidance equipment, whereas Lee at el [9].

utilized the 3D-CRT technique in a substantial number of patients (20.9%). Moreover, all of our patients were instructed to follow the preparation protocol for the urinary bladder and bowel before radiation. This may further reduce the irradiation dose to these organs at risk. Compared to the CHHiP trial [7], our population exhibited a further reduction in late GI toxicity. This could be attributed to the complete adoption of image-guided radiation therapy in our center, whereas image-guided techniques were used in only 30% of the patients in the CHHiP trial.

Our study has several limitations. First, this was a single-center, single-arm retrospective study. Second, the sample size was relatively small, especially for the low-risk and N1 disease groups. An insufficient number of events can impact certain oncological outcomes, necessitating cautious interpretation. Third, the follow-up duration is also relatively short for prostate cancer patients, as prostate cancer-specific survival is generally long. Fourth, there was discrepancy in the duration of ADT reported in our present study as compared to guidelines, probably due to variable patient compliance or tolerability and possible missing or incomplete medical record. Fifth, we did not analyze the effects of pelvic nodal irradiation on treatment-related toxicity or disease control.

## Conclusions

Hypofractionated image-guided radiotherapy, delivering 70 Gy at 2.5 Gy per fraction, is both effective and safe for Taiwanese patients with prostate cancer across all risk groups, consistent with findings from existing large randomized trials and previous studies. Late GI and GU toxicity could be further alleviated by selecting optimal dose fractions, advancing radiotherapy techniques, using image guidance and appropriate organ preparation. Therefore, as a solution to enhance patient convenience, hypofractionated radiotherapy is a reasonable option for the definitive treatment of prostate cancer.

#### Abbreviations

| | |
|---|---|
| ADT | Androgen deprivation therapy |
| CTV | Clinical target volume |
| CT | Computed tomography |
| GI | Gastrointestinal |
| GU | Genitourinary |
| Gy | Gray |
| GTV | Gross tumor volume |
| MRI | Magnetic resonance imaging |
| MVCT | Megavoltage computed tomography |
| PORT | Prostate-only radiotherapy |
| PSA | Prostate-specific antigen |
| PTV | Planning target volume |
| WPRT | Whole-pelvic radiotherapy |

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#### Author contributions

HLM collected the data and wrote the original draft of the paper. KLY had the idea, designed the study, analyzed the data, and revised and confirmed the manuscript. MSC, HLK, GDJ, TISH, KHC and KLY provided clinical data. All the authors have read and approved the final manuscript.

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#### Data availability

The data presented in this study are available upon reasonable request from the corresponding author in anonymized form after a data privacy check. The data are not publicly available due to data privacy regulations.

## Declarations

#### Ethics approval and consent to participate

This retrospective study was approved by the Ethics Committee of Shin Kong Wu Ho-Su Memorial Hospital (reference number 20230806R), and informed consent was obtained from all patients before treatment.

#### Consent for publication

Not applicable, as the data were analyzed in anonymized form and did not contain data from any individual person.

#### Competing interests

The authors declare no competing interests.

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