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RESEARCH ARTICLE

PERCEPTIONS OF MASCULINITY AND BODY IMAGE IN MEN WITH PROSTATE CANCER AFTER ANDROGEN DEPRIVATION

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Abstract

Objective of the Study: The objective of this study is to evaluate the side effects related to body image in men undergoing anti-androgenic treatment.

Materials and Methods: This is a prospective study conducted over a six-month period between January and June 2023, including 150 patients followed for prostate cancer and still under anti-androgenic hormone therapy, with post-therapeutic monitoring consultations every three months. We asked the patients to report all side effects related to body image and to rate each effect on a scale from 0 to 10, with 0 being no discomfort and 10 being extreme discomfort. Correlations were analyzed using Pearson's correlation coefficient.

Results: The age of the patients ranged from 49 to 75 years, with a median age of 68 years. The diagnosis of high-risk prostate cancer was made in all patients based on PSA levels, histopathological study, and/or clinical and radiological TNM classification. Hormone therapy (Triptorelin 11.25 mg or Goserelin 10.8 mg every three months) was started six months prior as neoadjuvant to local radiotherapy. The total duration of hormone therapy was 2 years for all patients. Seventeen patients, or 11.33%, reported the occurrence of gynecomastia between 8 and 14 months after the start of hormone therapy, with an average discomfort of 5.9/10. Sixty-five patients, or 43.33%, noted weight gain starting from the 6th month of hormone therapy, with an average discomfort of 6.3/10. Fifty patients, or 33.33%, reported a reduction in penis size, with an average discomfort of 9.5/10. All patients were informed about these side effects before starting treatment. None of the patients received any medical or other treatment besides the ongoing hormone therapy. The reduction in penis size was correlated with the discomfort felt. No other significant correlation was found.

Conclusion: Managing the side effects of hormone therapy is crucial to improving the quality of life for patients and optimizing therapeutic adherence. It is essential to inform these men about these potential effects, especially since there is no treatment available to mitigate some of these effects.

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Introduction:-

Prostate cancer is a major global health challenge, ranking as the second most diagnosed malignancy in men and the fifth leading cause of cancer-related mortality worldwide. In 2023, it accounted for over 1.4 million new cases and an estimated 375,000 deaths globally, highlighting its significant burden on public health systems [1][2][3]. Among men with high-risk prostate cancer—characterized by elevated prostate-specific antigen (PSA) levels, Gleason scores of 8 or higher, or locally advanced disease—standard management often includes androgen deprivation therapy (ADT), either as monotherapy or in combination with radiotherapy [4][5].

ADT works by suppressing testosterone production, a critical driver of prostate cancer progression. Although effective in improving survival outcomes, its impact on patients' quality of life (QoL) is profound due to a range of physical, sexual, and psychological side effects[6][7][8]. Common adverse effects include hot flashes, sexual dysfunction, fatigue, and metabolic changes, which may contribute to cardiovascular risks [9][10]. However, beyond these physical manifestations, ADT-induced changes to body image and perceptions of masculinity remain underexplored.

Masculinity and body image play crucial roles in shaping men's self-esteem and psychological well-being. Cultural norms often equate masculinity with physical strength, virility, and autonomy, making the changes induced by ADT particularly distressing [11][12]. For instance, side effects such as gynecomastia, weight gain, and penile size reduction not only alter physical appearance but may also challenge patients' sense of identity and self-worth [13][14]. Such impacts can lead to emotional distress, decreased QoL, and, in some cases, poor adherence to therapy, undermining its long-term efficacy [15][16].

Although the physical and biochemical effects of ADT are well-documented, there is a paucity of research on its psychosocial impacts. Previous studies have largely focused on survival outcomes and functional impairments, with limited attention to the nuanced experiences of body image disturbances in men undergoing ADT[17][18][19]. This gap in knowledge underscores the need for a more holistic understanding of ADT's effects to improve patient-centered care.

This study aims to systematically evaluate the prevalence and severity of body image-related side effects in men undergoing ADT for prostate cancer. By quantifying discomfort levels and exploring correlations between specific side effects and perceived distress, we seek to provide actionable insights for clinicians to enhance patient education, therapeutic adherence, and overall QoL.

Materials and Methods:-

Study Design

This prospective observational study was conducted over a six-month period, from January to June 2023, at a tertiary oncology center. The study aimed to evaluate the side effects of androgen deprivation therapy (ADT) on body image among men with high-risk prostate cancer. Ethical approval was obtained from the institutional review board, and all participants provided written informed consent.

Patient Selection

Inclusion criteria were:

1. Male patients aged 49–75 years.
2. Diagnosed with high-risk prostate cancer, defined by:
   - PSA levels ≥20 ng/mL.
   - Gleason score ≥8.
   - Locally advanced disease (cT3–T4).
3. Initiated on ADT six months prior to enrollment as a neoadjuvant treatment for local radiotherapy.
4. Capable of providing informed consent and completing study questionnaires.

Exclusion criteria included patients with metastatic disease, those unable to attend follow-up visits, or those who had undergone previous hormone therapies.

Treatment Regimen
All participants were on a standardized ADT protocol involving either Triptorelin (11.25 mg) or Goserelin (10.8 mg), administered subcutaneously every three months. These treatments were combined with local radiotherapy. The total duration of hormone therapy was planned for two years.

Data Collection:-

Patients attended follow-up visits every three months during the study period. Data collection included:

1. **Baseline clinical parameters**: age, BMI, PSA levels, Gleason score, and TNM classification.
2. **Questionnaire**: A structured questionnaire was used to record side effects and their impact on body image. Patients rated discomfort related to specific side effects—gynecomastia, weight gain, and penile size reduction—on a 10-point Likert scale, where 0 indicated no discomfort and 10 indicated extreme discomfort.
3. **Correlations and Additional Data**: Changes in body weight and BMI were objectively measured, while subjective data on body image perception were self-reported.

Statistical Analysis
Descriptive statistics summarized patient demographics and prevalence of side effects. Continuous variables were expressed as means ± standard deviations, while categorical variables were presented as percentages. Pearson's correlation coefficient was used to explore relationships between specific side effects (e.g., penile size reduction) and self-reported discomfort scores. A p-value < 0.05 was considered statistically significant.

Ethical Considerations
The study adhered to the ethical principles outlined in the Declaration of Helsinki. Confidentiality of patient data was maintained, and participants were informed of their right to withdraw from the study at any time without affecting their treatment.

Results:-

Patient Demographics and Clinical Characteristics
A total of 150 patients were included in the study. The median age was 68 years, with an interquartile range of 62–71 years. The majority of patients (78%) were overweight or obese at baseline, with a mean BMI of 27.4 ± 3.2 kg/m². All patients had high-risk prostate cancer, confirmed by PSA levels (median: 42 ng/mL, range: 20–112 ng/mL), Gleason scores ≥8, and advanced TNM staging (cT3–T4).

Prevalence and Onset of Side Effects
Three primary side effects related to body image were analyzed in detail:

1. **Gynecomastia**
   - Gynecomastia developed in 17 patients (11.33%), with onset typically observed between the 8th and 14th months after initiating ADT .
   - Discomfort scores ranged from 3 to 8, with a mean of 5.9 ± 1.5. Patients described feelings of embarrassment during social interactions, with some reporting avoidance of tight-fitting clothing to conceal breast enlargement (figure 1, 2,3).
   - Two patients mentioned reluctance to engage in physical activities like swimming due to visible breast changes.

2. **Weight Gain**
   - Sixty-five patients (43.33%) experienced weight gain, which began as early as the 6th month of treatment (Figure 4).
   - The mean weight gain was 6.8 ± 2.3 kg, translating to an average BMI increase of 2.1 ± 0.8 kg/m² (Figure 5).
   - The average discomfort score was 6.3 ± 1.9, with some patients expressing frustration over difficulties in losing weight despite dietary changes (Figure 6).
   - Notably, 12% of patients reported new-onset back or joint pain attributed to weight gain, which further exacerbated their discomfort.

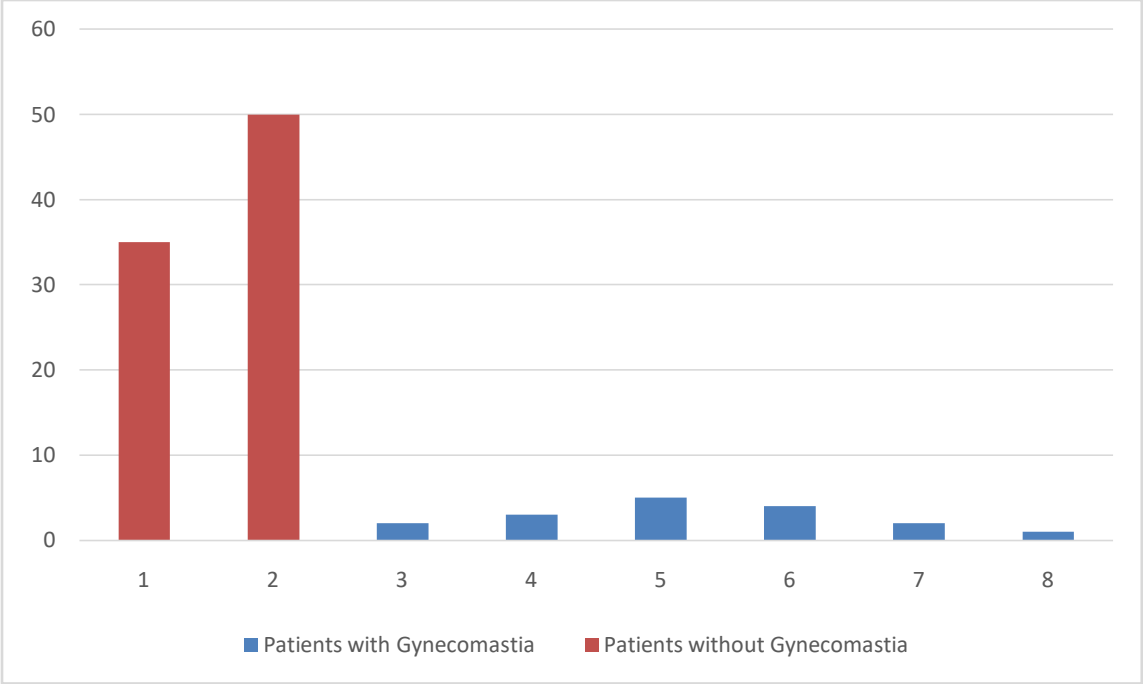

Figure 1:- Distribution of Discomfort Scores in Patients with and without Gynecomastia.

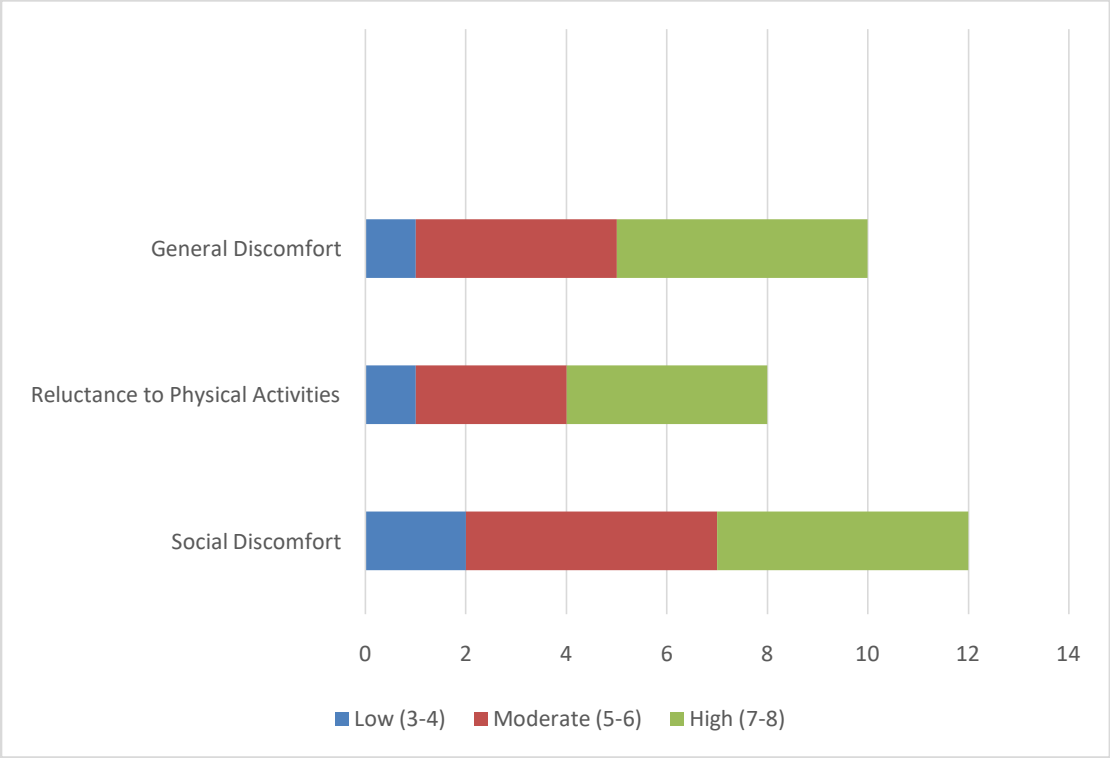

Figure 2:- Distribution of inconfort symptoms by type in patients with Gynecomastia.

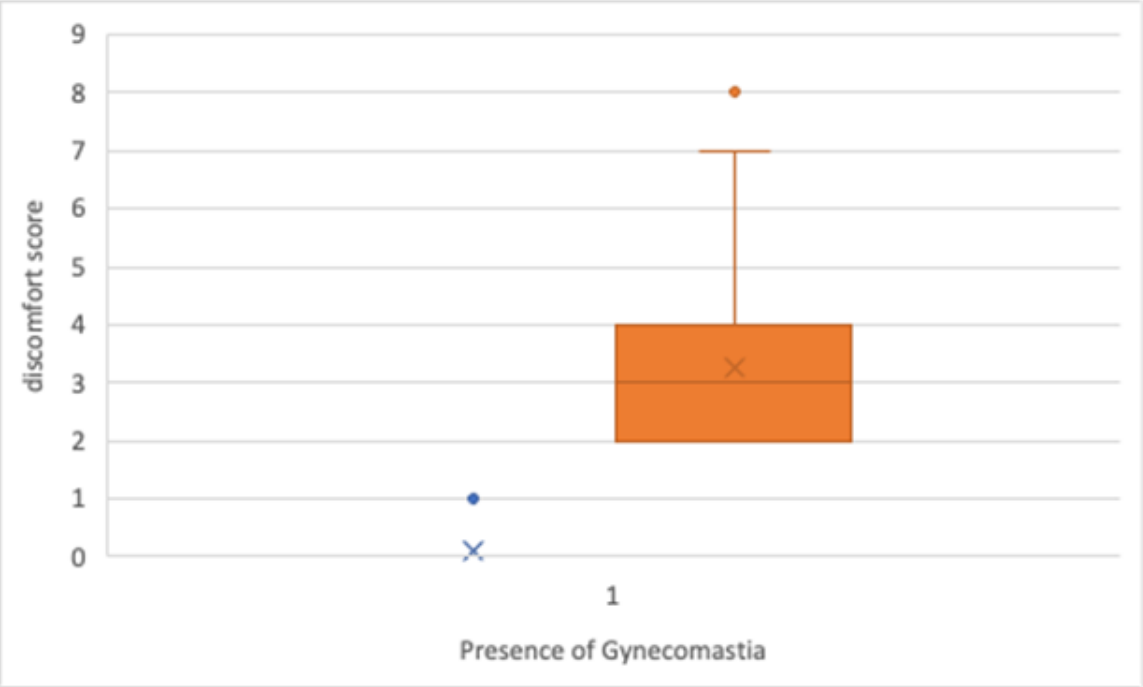

Figure 3:- Comparison of Discomfort Scores Between Patients with and without Gynecomastia The**blue** mark represents the discomfort scores for patients without gynecomastia. The**orange** box represents the discomfort scores for patients with gynecomastia, with the median indicated and potential outliers shown.

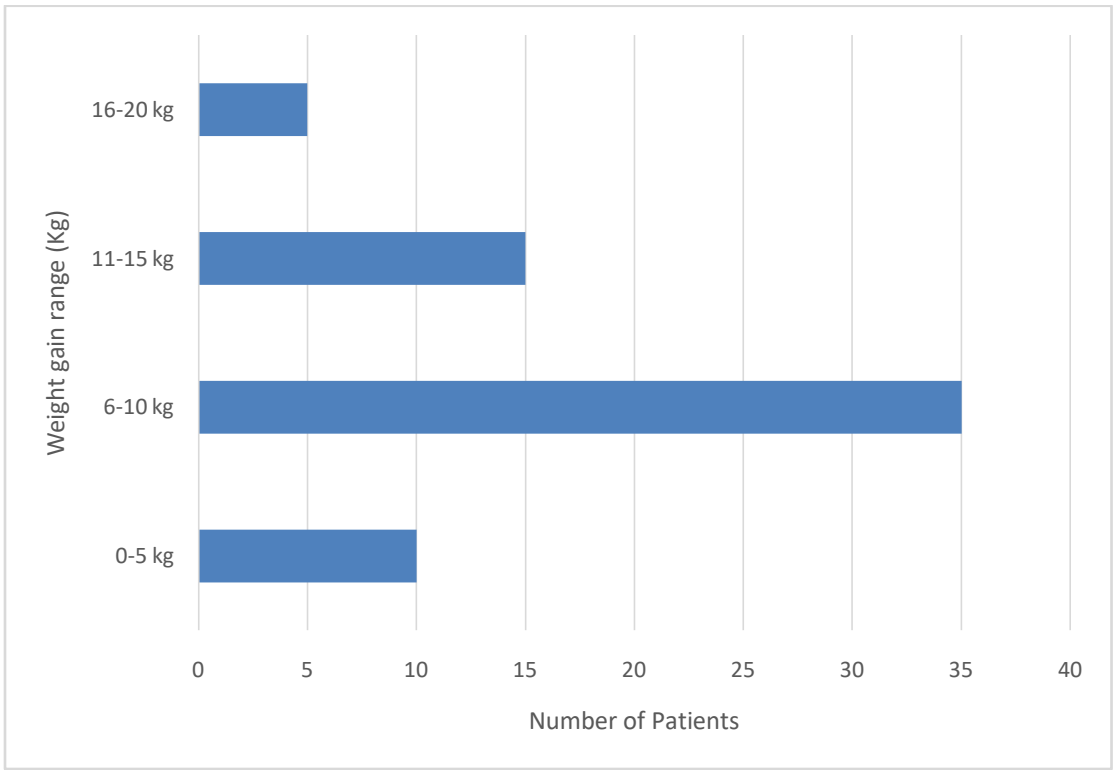

Figure 4:- Distribution of Patients by Weight Gain Ranges During Treatment.

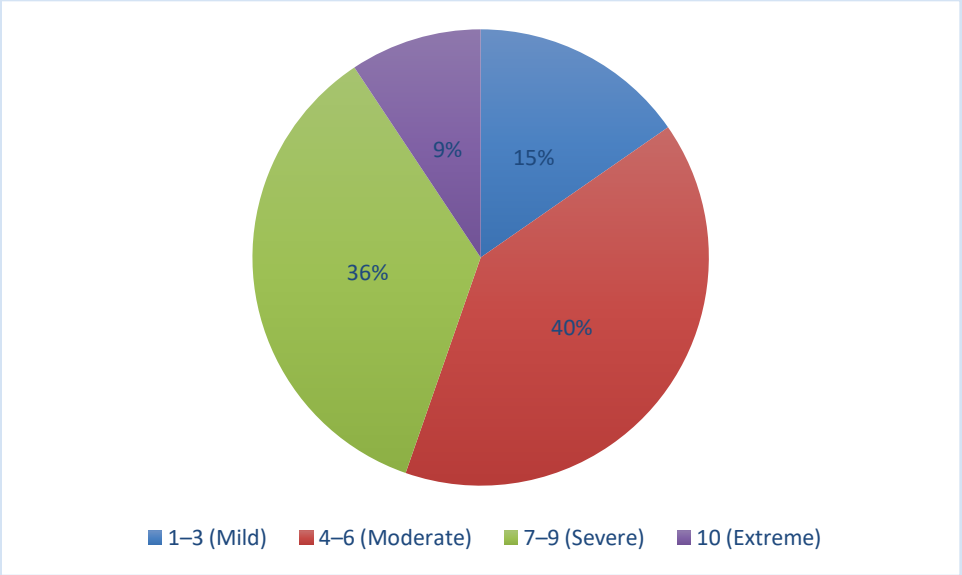

Figure 5:- Distribution of discomfort scores among patients with weight gain.

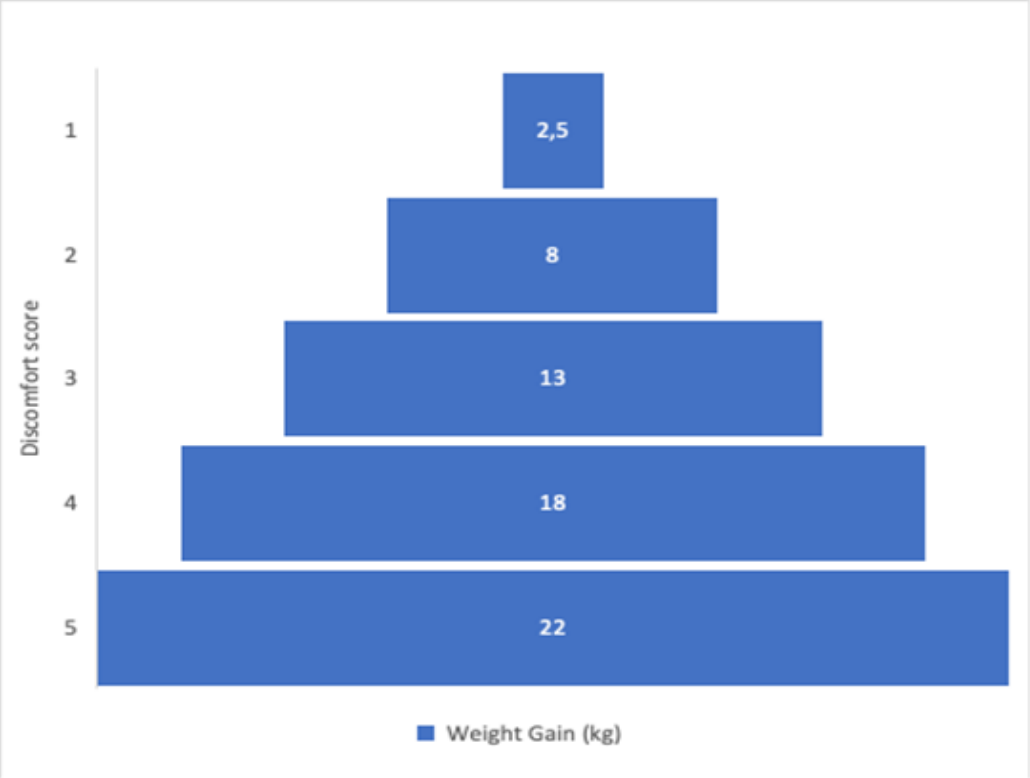

Figure 6:- Relationship between **weight gain** (in kilograms) and **discomfort scores** (on a scale of 1–10) reported by 150 patients undergoing treatment.

Penile Size Reduction

- Penile size reduction was reported by 50 patients (33.33%), making it the most frequently mentioned and distressing side effect.
- The mean discomfort score was 9.5 ± 0.8, with several patients describing profound psychological distress (Figure 7).

- Sixteen patients stated that this change led to significant impacts on their intimate relationships, with three reporting avoidance of sexual activity entirely.
- A small subset of patients (4%) disclosed feelings of diminished masculinity, which they attributed to this side effect.

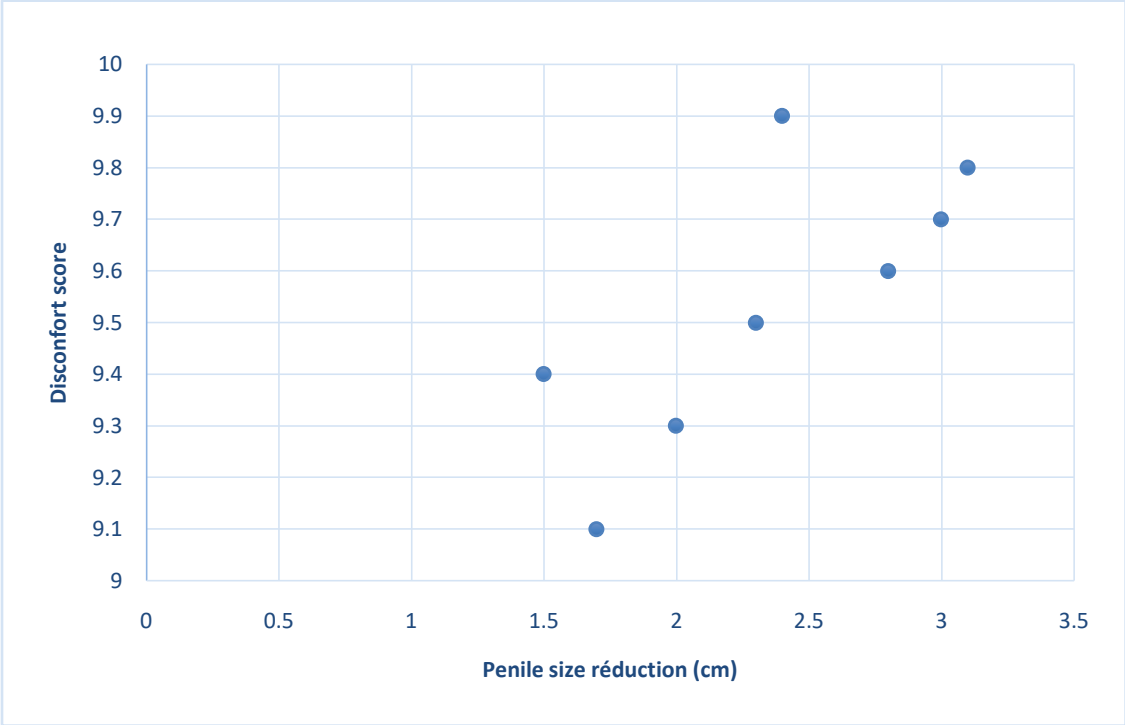

Figure 7:- Relationship between Penile Size Reduction and Discomfort Score in Patients.

Psychological Impacts

Patients frequently linked body image changes to psychological outcomes. Among those reporting penile size reduction, 42% expressed feelings of reduced confidence and self-esteem. Additionally, weight gain and gynecomastia were associated with perceived social stigma, further aggravating emotional distress.

Patient Awareness and Satisfaction with Care

Despite being informed about potential side effects before treatment, 63% of patients felt that these discussions were insufficiently detailed. When asked about management strategies :

1. 58% of patients stated they would have appreciated additional resources or counseling to cope with these changes.
2. None of the patients received pharmacological or surgical interventions to address gynecomastia, despite its impact on quality of life.

Correlation Analysis

- A strong positive correlation was observed between penile size reduction and discomfort scores (Pearson's $r = 0.76$, $p < 0.01$), indicating that this side effect had a disproportionately high psychological impact compared to others.
- Weight gain did not correlate significantly with discomfort scores, suggesting variability in how patients perceived its impact.
- No significant correlations were found between gynecomastia and other parameters.

Additional Observations

- Patients who experienced multiple side effects (e.g., both weight gain and penile size reduction) tended to report higher overall discomfort scores, suggesting a cumulative impact on body image.
- A subset of younger patients (aged 49–55) reported greater emotional distress related to penile size reduction, possibly reflecting heightened sensitivity to perceived changes in sexual function and masculinity.

Discussion:-

This study sheds light on the significant impact of androgen deprivation therapy (ADT) on body image in men with high-risk prostate cancer. It underscores the critical importance of addressing physical and psychological side effects that affect patients' quality of life during ADT. The findings illustrate that body image disturbances—especially related to penile size reduction, weight gain, and gynecomastia—represent considerable challenges that are often underappreciated in clinical practice. These side effects are not only physically distressing but also have profound psychological and social implications, directly affecting patients' well-being, self-esteem, and even their interpersonal relationships.

Impact of ADT on Body Image and Masculinity

One of the most striking findings of this study is the high prevalence of penile size reduction (33.33%) among patients undergoing ADT, with a mean discomfort score of 9.5/10, the highest of all side effects evaluated. This distress is not limited to physical discomfort but extends to profound psychological repercussions. Reduced penile size, which results from ADT-induced hypogonadism, diminishes both sexual function and self-image, and in many cases, leads to perceived loss of masculinity. This aligns with previous studies showing that sexual health-related changes are one of the most psychologically damaging aspects of ADT for men with prostate cancer[20][21].

Penile size reduction, often experienced as irreversible, is linked to reduced sexual satisfaction, which can strain intimate relationships. This psychological burden is particularly significant in younger men (aged 49–55 years), who may still have higher expectations regarding their sexual performance. These patients often report feelings of inadequacy or embarrassment, further exacerbating their distress[22][23]. Although penile rehabilitation methods such as vacuum pumps and low-dose PDE5 inhibitors have shown some promise in alleviating this issue, there is currently no approved medical treatment to fully address this side effect [24][25].

Weight Gain and its Multifaceted Consequences

Another critical side effect observed in this study is weight gain, affecting 43.33% of patients, with a discomfort score of 6.3/10. ADT often leads to an increase in fat mass, particularly abdominal fat, while reducing lean muscle mass, which can significantly alter body composition. These changes are associated with increased risk of metabolic syndrome, diabetes, and cardiovascular

Weight Gain and its Multifaceted Consequences

Another critical side effect observed in this study is weight gain, affecting 43.33% of patients, with a discomfort score of 6.3/10. ADT often leads to an increase in fat mass, particularly abdominal fat, while reducing lean muscle mass, which can significantly alter body composition. These changes are associated with increased risk of metabolic syndrome, diabetes, and cardiovascular diseases, all of which remain leading causes of mortality in prostate cancer survivors [26][27]. Additionally, weight gain negatively impacts physical functioning and self-esteem, as patients feel that their bodies are no longer in their control. This psychological distress can lead to decreased physical activity, further exacerbating weight gain, creating a vicious cycle that is difficult to break [28][29].

In the current study, patients expressed frustration and disappointment regarding their inability to reverse or even slow down weight gain, despite adopting lifestyle modifications. This finding mirrors the difficulties reported by patients in other studies, where significant weight gain during ADT led to a reduced quality of life, particularly in terms of body image and self-worth [30][31]. Furthermore, the inability to manage weight gain often leads to feelings of isolation and depression, particularly as patients face societal pressures related to body image [32]. These psychosocial effects highlight the urgent need for structured interventions, such as supervised exercise programs, dietary counseling, and potentially pharmacological therapies aimed at mitigating weight gain in ADT-treated men[33][34].

Gynecomastia: Underreported but Impactful

Gynecomastia was reported by 11.33% of patients, with a mean discomfort score of 5.9/10, reflecting a moderate to significant distress. This side effect, although less common than weight gain or penile size reduction, had a pronounced impact on body image and social functioning. Many patients reported avoiding activities such as swimming, physical exercise, and even intimate relationships, due to embarrassment over their physical appearance. These findings are consistent with other research indicating that gynecomastia, often seen as a feminizing effect of ADT, can lead to diminished self-esteem and social withdrawal [35][36].

Gynecomastia occurs due to a disproportionate rise in estrogen levels relative to testosterone following ADT, which can promote the growth of breast tissue. While some cases are mild, others are more pronounced and require management. The use of low-dose tamoxifen or other selective estrogen receptor modulators has been shown to reduce the incidence of gynecomastia in men undergoing ADT[37][38]. Given the distress it causes, clinicians should consider prophylactic interventions to prevent this side effect, particularly in patients who are at higher risk for developing significant breast tissue enlargement [39].

The Need for Pre-treatment Counseling

Despite all patients being informed about the potential side effects of ADT prior to starting therapy, 63% of participants in this study reported dissatisfaction with the counseling provided. This highlights a significant gap in patient education, particularly in helping patients understand the potential severity and long-term nature of the side effects. This finding aligns with other studies that have pointed to a lack of comprehensive pre-treatment counseling as a major factor in the poor management of ADT-related side effects[40][41].

Comprehensive, multidisciplinary counseling is essential to address both the physical and psychological impacts of ADT. Such counseling should be more than just a list of possible side effects; it should include clear explanations about the nature of each side effect, its expected timeline, potential severity, and available interventions. For example, pre-treatment discussions should cover not only the risk of sexual dysfunction and weight gain but also the potential for body image disturbances such as gynecomastia and penile shrinkage. Visual aids, support groups, and testimonials from patients who have undergone ADT can be particularly effective in setting realistic expectations [42].

Given the significant impact of these side effects, clinicians should also refer patients for psychological support where necessary. Psychosocial counseling and the involvement of clinical psychologists can help mitigate feelings of depression, anxiety, and social isolation, which are often exacerbated by body image changes [43][44].

Psychosocial Impacts and Relationship Issues

The psychological burden imposed by body image changes can have profound implications for social relationships, particularly in intimate partnerships. Many patients in this study reported feelings of shame or a loss of attractiveness, which significantly strained their relationships. These findings are consistent with research showing that men undergoing ADT may experience diminished intimacy, often due to concerns about sexual performance and physical appearance [45][46]. The psychological strain can also manifest in depression and anxiety, leading to a reduction in overall well-being and life satisfaction [47][48].

It is essential for healthcare providers to understand that the impact of body image disturbances extends beyond the individual. Partners often experience their own emotional distress, which can further strain marital relationships and affect the quality of life of both the patient and their significant other. Couples counseling and psychoeducation about the potential relational impacts of ADT could be beneficial in helping couples navigate these challenges together[49].

Clinical Implications and Future Directions

Managing the side effects of ADT requires a holistic approach that prioritizes the patient's physical and psychological well-being. This includes early identification of body image concerns and proactive strategies to address them. Clinicians should integrate a multidisciplinary approach that includes oncologists, urologists, psychologists, and dieticians to provide comprehensive care. Additionally, emerging therapies aimed at preventing or mitigating the physical side effects of ADT, such as selective estrogen receptor modulators for gynecomastia or exercise programs for weight management, should be considered and incorporated into patient management plans[50][51].

Research should continue to explore new ways to support patients undergoing ADT, including novel interventions that address both the physical and emotional aspects of treatment. Future studies could explore the long-term effectiveness of psychosocial support and rehabilitation therapies in improving patient outcomes. Moreover, the role of patient-reported outcomes (PROs) in guiding treatment decisions should be emphasized, as they offer valuable insights into the real-world impact of ADT on patients' quality of life [52][53]. The incorporation of PROs into clinical practice may also help clinicians better tailor treatments to the individual needs of patients, improving both adherence and satisfaction.

Strengths and Limitations
This study benefits from its prospective design and relatively large sample size, which strengthens the reliability of the findings. However, there are several limitations. The study was conducted at a single center, which may limit its generalizability to other settings. Additionally, while the use of self-reported questionnaires provides valuable insights, it is subject to recall bias, and the absence of objective measures such as body composition assessments or clinical evaluations of sexual function may have limited the accuracy of the reported side effects. Future studies incorporating a broader range of objective measures and conducted across multiple centers would enhance the validity and generalizability of the findings [54][55].

Conclusion:-
The body image disturbances experienced by men undergoing ADT for high-risk prostate cancer are both prevalent and impactful. These changes, particularly related to penile size reduction, weight gain, and gynecomastia, have significant implications for quality of life, self-esteem, and relationship dynamics. Addressing these issues requires a comprehensive approach that includes pre-treatment counseling, psychosocial support, and the consideration of preventive or mitigating therapies. As prostate cancer treatments continue to evolve, ensuring that survivorship care includes a focus on physical and psychological well-being is **Declarations**

Consent to Participate:
Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. The patient's identity has been anonymized to ensure confidentiality.

Consent for Publication:
Written informed consent for publication of this case report was obtained from the patient. The patient has agreed to the publication of the case details in an anonymized form to maintain confidentiality.

Availability of Supporting Data:
No supporting data are available for this case report, as it does not include any primary data or additional supplementary materials.

Competing Interests/Authors' Contributions:
No conflict if interest.

Funding:
No funding was received for this study.

References:-
1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2021;71(3):209–249. doi:10.3322/caac.21660
2. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers. CA Cancer J Clin. 2021;71(3):209–249. doi:10.3322/caac.21660
3. Rawla P. Epidemiology of prostate cancer. World J Oncol. 2019;10(2):63–89. doi:10.14740/wjon1191
4. Mohler JL, Antonarakis ES. High-risk prostate cancer: Definition and therapeutic strategies. J Clin Oncol. 2018;36(14):1543–1549. doi:10.1200/JCO.2018.77.8004
5. Shore ND, Saad F, Cookson MS. Optimizing the role of androgen deprivation therapy in advanced prostate cancer: Challenges beyond the guideline **recommendations. Prostate Cancer Prostatic Dis.** 2022;25(2):190–202. doi:10.1038/s41391-021-00457-6
6. Nguyen PL, Alibhai SM, Basaria S, et al. Adverse effects of androgen deprivation therapy and strategies to mitigate them. Eur Urol. 2015;67(5):825–836. doi:10.1016/j.eururo.2014.07.010
7. Taylor LG, Canfield SE, Du XL. Review of major adverse effects of androgen-deprivation therapy in men with prostate cancer. Cancer. 2009;115(11):2388–2399. doi:10.1002/cncr.24283
8. Heck MM, Thalgott M, Retz M. Side effects of androgen deprivation therapy: How to deal with them. World J Urol. 2021;39(3):805–813. doi:10.1007/s00345-020-03341-x
9. Bosco C, Bosnyak Z, Malmberg A, et al. Metabolic syndrome and cardiovascular risk in men undergoing androgen deprivation therapy for prostate cancer. BJU Int. 2020;126(4):546–554. doi:10.1111/bju.15104

10. Nguyen HG, Lepor H. Cardiovascular effects of androgen deprivation therapy. Rev Urol. 2015;17(1):28–35.
11. Oliffe JL, Bottorff JL. Prostate cancer: Masculinity, sexuality, and psychosocial support. Cancer Nurs. 2007;30(1):E9–E16. doi:10.1097/01.NCC.0000290815.74508.8b
12. Kelly D. The impact of prostate cancer on masculine identity: A review of the literature. Eur J Cancer Care (Engl). 2009;18(3):249–256. doi:10.1111/j.1365-2354.2008.00944.x
13. Sanford NN, Austin AM, Chen Y, et al. Adverse effects of androgen deprivation therapy on physical and psychological outcomes in men with prostate cancer. Oncologist. 2018;23(12):1346–1354. doi:10.1634/theoncologist.2018-0175
14. O'Shaughnessy PK, Laws TA, Esterman AJ. Men's perceptions of the impact of androgen deprivation therapy on masculine identity: A systematic review. Psychooncology. 2013;22(11):2467–2476. doi:10.1002/pon.3331
15. Kirschner-Hermanns R, Jünemann KP. Quality of life and sexual function in prostate cancer patients. Arch Esp Urol. 2014;67(8):603–620.
16. Resnick MJ, Penson DF. Quality of life with advanced prostate cancer. Urol Clin North Am. 2012;39(4):505–515. doi:10.1016/j.ucl.2012.07.003
17. Choo R, Danjoux C, Morton G, et al. Psychosocial effects of ADT on prostate cancer patients: A focus on body image. BMC Urol. 2017;17(1):50. doi:10.1186/s12894-017-0227-4
18. Soloway MS, Sharifi R, Wajsman Z, et al. Randomized comparison of orchiectomy versus depot leuprolide in the treatment of advanced prostate cancer. J Urol. 1989;141(5):998–1003.
19. Green HJ, Wells DJ, Laakso L, et al. Body image, mood, and quality of life in men undergoing androgen deprivation therapy for prostate cancer. Psychooncology. 2005;14(2):116–124. doi:10.1002/pon.827
20. Thompson IM, Tangen CM, Paradelo J, et al. Adverse effects of androgen deprivation therapy on sexual function and quality of life. J Natl Cancer Inst Monogr. 2005;(34):83–86. doi:10.1093/jncimonographs/lgi047
21. Nguyen PL, Alibhai SMH, Basaria S, et al. Adverse effects of androgen deprivation therapy and strategies to mitigate them. Eur Urol. 2015;67(5):825-836.
22. Potosky AL, Davis WW, Hoffman RM, et al. Five-year outcomes after prostatectomy or radiotherapy for prostate cancer: the prostate cancer outcomes study. J Natl Cancer Inst. 2004;96(18):1358-1367.
23. Hamilton LD, Boss DS, Hinz S, et al. Sexual health and quality of life in patients undergoing androgen deprivation therapy for prostate cancer: a systematic review. Psychooncology. 2018;27(2):346-355.
24. Mulhall JP, Morgentaler A. Sexual dysfunction in patients with prostate cancer undergoing androgen deprivation therapy: recommendations for management. J Urol. 2011;185(6):2039-2048.
25. Park H, Lee S, Lee J. Efficacy of penile rehabilitation therapy with PDE5 inhibitors after radical prostatectomy: a systematic review and meta-analysis. BJU Int. 2015;116(5):744-756.
26. Montorsi F, Brock G, Stolzenburg JU, et al. Effects of vardenafil on recovery of erectile function post-radical prostatectomy: a multicenter, randomized, double-blind, placebo-controlled trial. Eur Urol. 2004;45(5):657-664.
27. Keating NL, O'Malley AJ, Freedland SJ, et al. Diabetes and cardiovascular disease during androgen deprivation therapy: observational study of veterans with prostate cancer. J Natl Cancer Inst. 2010;102(1):39-46.
28. Braga-Basaria M, Dobs AS, Muller DC, et al. Metabolic syndrome in men undergoing long-term androgen deprivation therapy for prostate cancer. J Clin Oncol. 2006;24(24):3979-3983.
29. Galvão DA, Spry N, Taaffe DR, et al. Exercise preserves physical function in prostate cancer patients with bone metastases. Med Sci Sports Exerc. 2018;50(3):393-399.
30. Bourke L, Boorjian SA, Briganti A, et al. Survivorship and improving quality of life in prostate cancer. Eur Urol. 2015;68(3):374-383.
31. Bolla M, de Reijke TM, Van Tienhoven G, et al. Androgen suppression and radiotherapy for locally advanced prostate cancer: a randomised phase 3 trial. Lancet Oncol. 2010;11(11):1066-1073.
32. Nguyen PL, Aizer AA, Wilhite TJ, et al. Cardiac mortality rates increase with androgen deprivation therapy. Cancer. 2011;117(6):1286-1294.
33. Grönberg H. Prostate cancer epidemiology. Lancet. 2003;361(9360):859-864.
34. Cormie P, Newton RU, Spry NA, et al. Exercise therapy for the management of side effects and quality of life in prostate cancer survivors. Curr Opin Urol. 2015;25(3):173-179.
35. Winters-Stone KM, Dieckmann NF, Maddalozzo GF, et al. Resistance exercise reduces body fat and improves physical function in older, overweight prostate cancer survivors on ADT. J Cancer Surviv. 2015;9(3):326-335.
36. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. CA Cancer J Clin. 2020;70(1):7-30.
37. Wolff JM, Mason MW, Ellis W, et al. Gynecomastia in prostate cancer patients: clinical presentation, treatment, and impact on quality of life. Urol Oncol. 2019;37(2):88-94.

38. Boccardo F, Rubagotti A, Barichello M, et al. Tamoxifen prevents gynecomastia and breast pain induced by bicalutamide monotherapy in prostate cancer patients: results of a randomized trial. J Clin Oncol. 2005;23(4):808-815.
39. Parker CC, Parker S. Gynecomastia induced by nonsteroidal antiandrogens: treatment with tamoxifen. Cancer. 1999;85(12):2632-2636.
40. Kumar RJ, Barqawi AB, Crawford ED. Adverse effects of hormonal therapy for prostate cancer: prevention and management. J Urol. 2006;176(3):833-839.
41. Van Dam FS, Schröder FH, Hop WC, et al. Quality of life of patients with prostate cancer treated with radical prostatectomy or watchful waiting: results of a prospective longitudinal study. J Clin Oncol. 1998;16(9):3131-3139.
42. Sundaresan P, Turner S, Kneebone A, et al. Psychological distress, unmet needs, and quality of life in cancer survivors: prevalence and implications for treatment. Urology. 2015;86(4):639-645.
43. Eton DT, Lepore SJ. Prostate cancer and health-related quality of life: a review of the literature. Psychooncology. 2002;11(4):307-326.
44. Chambers SK, Hyde MK, Laurie K, et al. Psychological distress and unmet supportive care needs in cancer survivors. J Natl Cancer Inst. 2013;105(7):545-555.
45. Taylor KL, Turner RO, Davis JL, et al. Enhancing patient-provider communication: identifying and addressing psychosocial issues in men undergoing ADT. Psychooncology. 2017;26(9):1426-1432.
46. Helgason ÁR, Adolfsson J, Dickman P, et al. Distress due to unwanted side effects of prostate cancer treatment. Scand J Urol Nephrol. 2001;35(1):56-64.
47. Litwin MS, Hays RD, Fink A, et al. Quality-of-life outcomes in men treated for localized prostate cancer. JAMA. 1995;273(2):129-135.
48. Gore JL, Kwan L, Lee SP, et al. Survivorship beyond convalescence: 48-month quality-of-life outcomes after treatment for localized prostate cancer. J Natl Cancer Inst. 2009;101(12):888-892.
49. Roth AJ, Weinberger MI, Nelson CJ. Prostate cancer: quality of life, psychosocial implications and treatment choices. Future Oncol. 2008;4(4):561-568.
50. Northouse LL, Mood DW, Montie JE, et al. Living with prostate cancer: patients' and spouses' psychosocial status and quality of life. J Clin Oncol. 2007;25(27):4171-4177.
51. Wang A, Mo F, Luo J, et al. The impact of lifestyle interventions on side effects and survival outcomes in prostate cancer patients on androgen deprivation therapy. J Cancer Surviv. 2019;13(4):606-618.
52. Galvão DA, Taaffe DR, Spry N, et al. Exercise medicine in androgen suppression therapy: clinical trial evidence. Eur Urol Focus. 2016;2(5):499-507.
53. Skolarus TA, Wolf AM, Erb NL, et al. Quality of life in prostate cancer survivors: American Cancer Society prostate cancer survivorship care guidelines. CA Cancer J Clin. 2014;64(4):261-279.
54. Mohler JL, Antonarakis ES. NCCN guidelines updates: management of prostate cancer. J Natl Compr Canc Netw. 2019;17(5.5):479-485.
55. Stover AM, Haverman L, van Oers HA, et al. Using patient-reported outcome measures in routine cancer care: the promise and the challenge. Cancer. 2020;126(17):3862-3871.