National Comprehensive Cancer Network®

NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®)

Anal Carcinoma

Version 1.2025 — December 4, 2024

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NCCN Anal Carcinoma Panel Members
Summary of the Guidelines Updates

Workup and Treatment - Anal Canal Cancer (ANAL-1)
Workup and Treatment - Perianal Cancer (ANAL-2)
Follow-up Therapy and Surveillance (ANAL-3)

Principles of Surgery (ANAL-A)
Principles of Systemic Therapy (ANAL-B)
Principles of Radiation Therapy (ANAL-C)
Principles of Survivorship (ANAL-D)

Staging (ST-1)
Abbreviations (ABBR-1)

Find an NCCN Member Institution: https://www.nccn.org/home/member-institutions.

NCCN Categories of Evidence and Consensus: All recommendations are category 2A unless otherwise indicated.

See NCCN Categories of Evidence and Consensus.

NCCN Categories of Preference: All recommendations are considered appropriate.

See NCCN Categories of Preference.

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Updates in Version 1.2025 of the NCCN Guidelines for Anal Carcinoma from Version 1.2024 include:

ANAL-1
- Workup
  - Bullet 5 revised: Consider FDG-positron emission tomography (PET)/CT or FDG-PET/MRI ~~(if available)~~ (Also for bullet 3, sub-bullet 1 on ANAL-2)

ANAL-3
- Footnote o modified: Consider the use of immunotherapy (nivolumab, pembrolizumab, ~~or~~ retifanlimab-dlwr, *cemiplimab-rwlc, dostarlimab-gxly, tislelizumab-jsgr, or toripalimab-tpzi*) (category 2B) before proceeding to APR. Institutional experience has demonstrated that some patients receive a good response and can avoid surgery. (Also for ANAL-4)

ANAL-B 2 of 5
- Principles of Systemic Therapy- Metastatic Cancer
  - Tables have been revised and reformatted
  - First-Line Therapy
    - Other Recommended Regimens
      - Carboplatin + paclitaxel + retifanlimab-dlwr added as a category 2B recommendation
  - Second-Line and Subsequent Therapy
    - Preferred Regimens (if no prior immunotherapy received)
      - The following immunotherapy agents have been added:
        - Cemiplimab-rwlc
        - Dostarlimab-gxly
        - Tislelizumab-jsgr
        - Toripalimab-tpzi

ANAL-B 3 of 5
- Regimens and dosing updated.

ANAL-B 4 of 5
- References updated.

ANAL-C 2 of 5
- Principles of Radiation Therapy
  - Treatment Information (continued)
    - Target Volume Definition
      - Sub-bullet 4 modified: To define the gross disease CTV around involved nodes, a *0.5- to* 1-cm expansion should be made...

ANAL-C 5 of 5
- Treatment Information (continued)
  - Quality Assurance and Image-Guided Treatment Delivery
    - Sub-bullet 3 revised: If it is not possible to achieve the dosimetric goals in Table 2, small bowel max point dose should be limited to ~~50~~ *Dmax 55* Gy, V45 should be ~~<195~~ *≤150* cc for a bowel bag avoidance structure, and V~~15~~ *50* should be ~~<120~~ *≤30* cc for individual small bowel loops.
      - Reference added: Alvarez JA, Shi Q, Dasari A, et al. Alliance A022104/NRG-GI010: The Janus Rectal Cancer Trial: a randomized phase II/III trial testing the efficacy of triplet versus doublet chemotherapy regarding clinical complete response and disease-free survival in patients with locally advanced rectal cancer. Supplement 2. Protocol update to Alliance A022104. BMC Cancer 2024;24:901.

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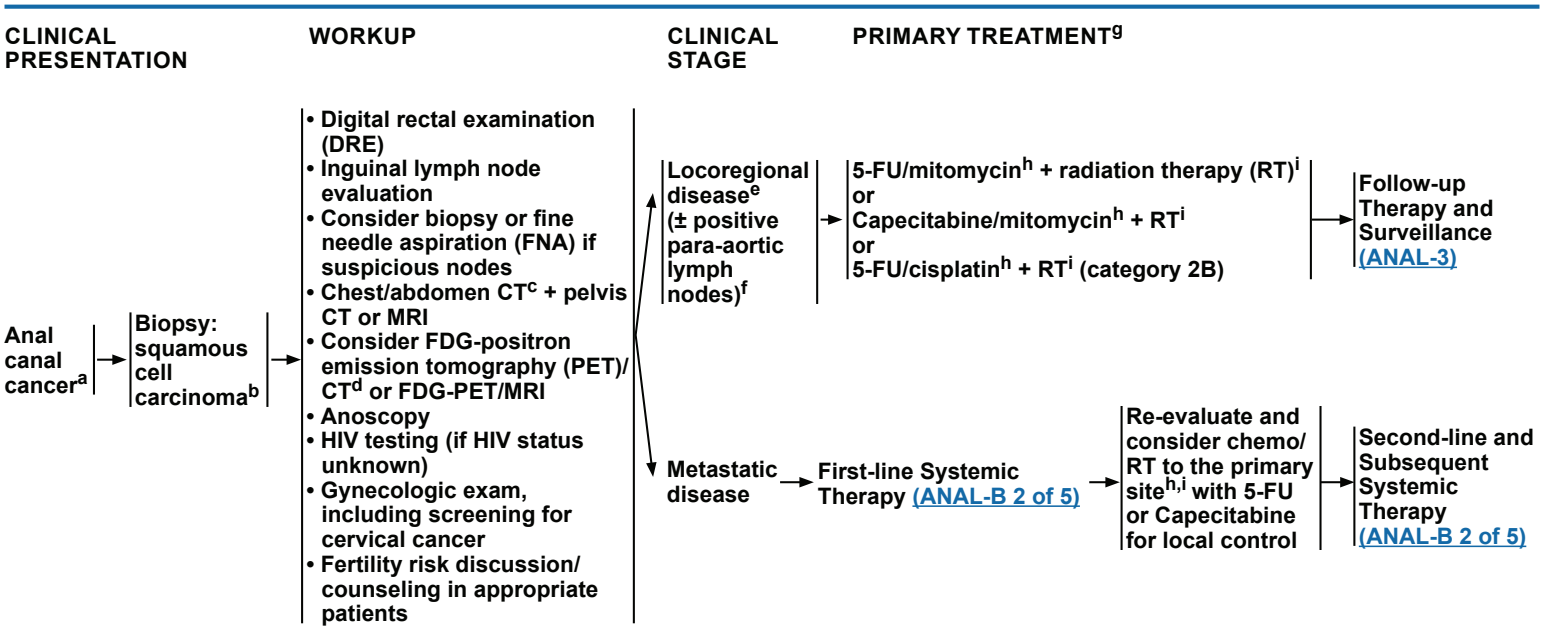

[a] The superior border of the functional anal canal, separating it from the rectum, has been defined as the palpable upper border of the anal sphincter and puborectalis muscles of the anorectal ring. It is approximately 3 to 5 cm in length, and its inferior border starts at the anal verge, the lowermost edge of the sphincter muscles, corresponding to the introitus of the anal orifice.
[b] For melanoma histology, see the NCCN Guidelines for Melanoma: Cutaneous; for adenocarcinoma, see the NCCN Guidelines for Rectal Cancer.
[c] CT should be with IV and oral contrast. Pelvis MRI with contrast. If intravenous iodinated contrast material is contraindicated due to significant contrast allergy or renal failure, then MRI examination of the abdomen and pelvis with IV gadolinium-based contrast agent (GBCA) can be obtained in select patients (see American College of Radiology contrast manual: https://www.acr.org/-/media/ACR/Files/Clinical-Resources/Contrast_Media.pdf). Intravenous contrast is not required for the chest CT.
[d] FDG-PET/CT scan does not replace a diagnostic CT. FDG-PET/CT performed skull base to mid-thigh.
[e] Principles of Surgery (ANAL-A).
[f] Para-aortic nodes that can be included in a radiation field.
[g] Modifications to cancer treatment should not be made solely based on HIV status. See NCCN Guidelines for Cancer in People with HIV.
[h] Principles of Systemic Therapy (ANAL-B).
[i] Principles of Radiation Therapy (ANAL-C).

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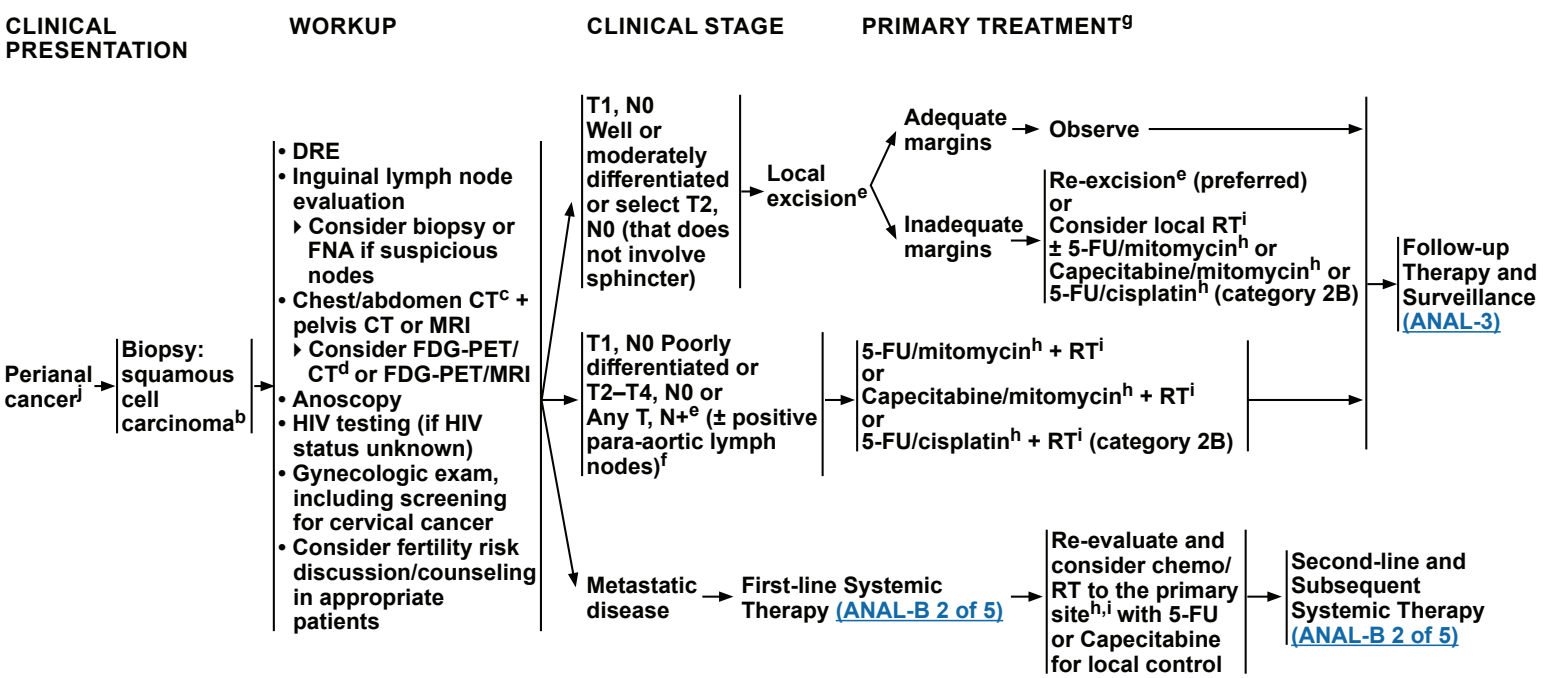

[b] For melanoma histology, see the NCCN Guidelines for Melanoma: Cutaneous; for adenocarcinoma, see the NCCN Guidelines for Rectal Cancer.

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[e] Principles of Surgery (ANAL-A).

[f] Para-aortic nodes that can be included in a radiation field.

[g] Modifications to cancer treatment should not be made solely based on HIV status. See NCCN Guidelines for Cancer in People with HIV.

[h] Principles of Systemic Therapy (ANAL-B).

[i] Principles of Radiation Therapy (ANAL-C).

[j] The perianal region starts at the anal verge and includes the perianal skin over a 5-cm radius from the squamous mucocutaneous junction.

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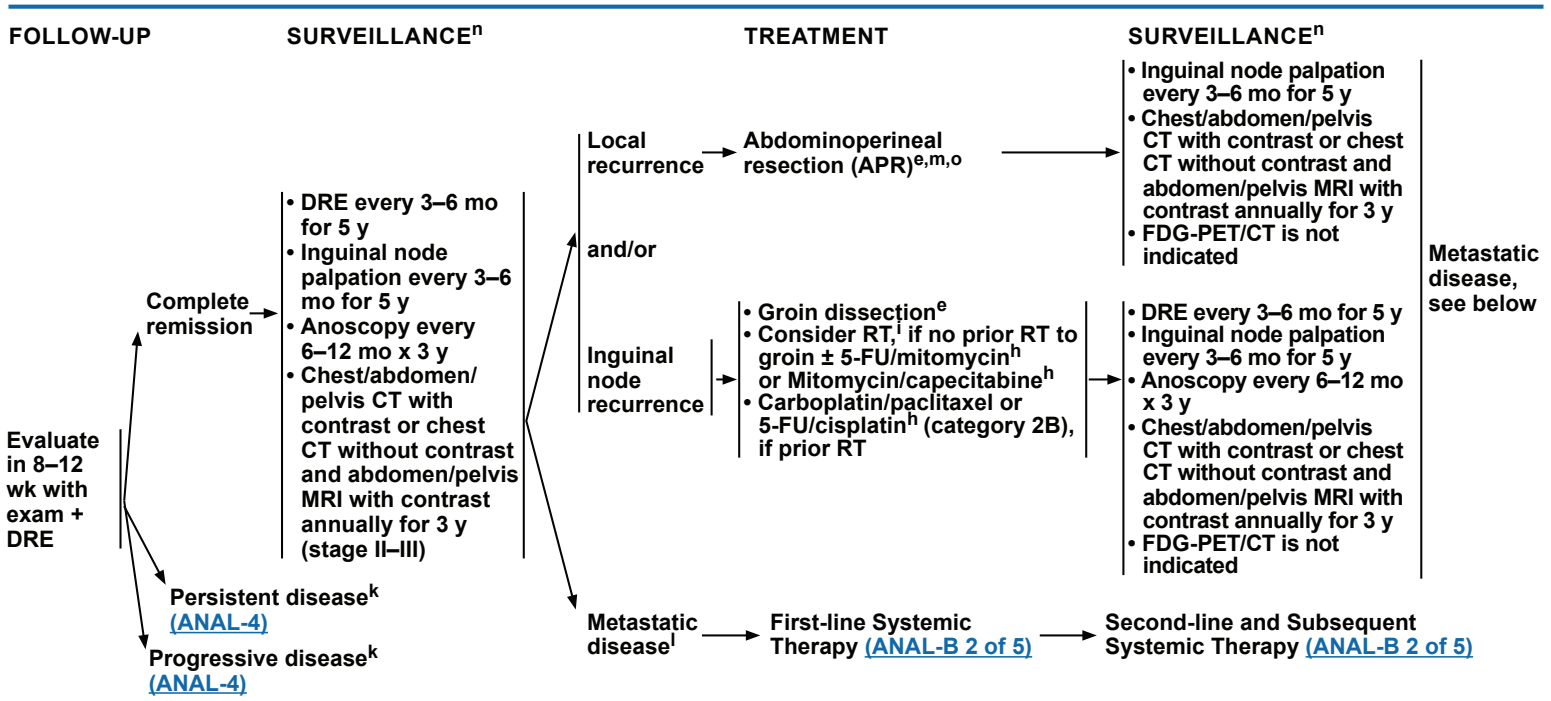

[e] Principles of Surgery (ANAL-A).
[h] Principles of Systemic Therapy (ANAL-B).
[i] Principles of Radiation Therapy (ANAL-C).
[k] Based on the results of the ACT-II study, it may be appropriate to follow patients who have not achieved a complete clinical response with persistent anal cancer up to 6 months following completion of RT and chemotherapy as long as there is no evidence of progressive disease during this period of follow-up. Persistent disease may continue to regress even at 26 weeks from the start of treatment. James RD, et al. Lancet Oncol 2013;14:516-524.
[l] Palliative RT may be considered in symptomatic patients. Records of previous RT should be carefully reviewed and considered prior to potential re-irradiation of previously irradiated fields. See Principles of Radiation Therapy (ANAL-C).
[m] Consider muscle flap reconstruction.
[n] Principles of Survivorship (ANAL-D).
[o] Consider the use of immunotherapy (nivolumab, pembrolizumab, retifanlimab-dlwr, cemiplimab-rwlc, dostarlimab-gxly, tislelizumab-jsgr, or toripalimab-tpzi) (category 2B) before proceeding to APR. Institutional experience has demonstrated that some patients receive a good response and can avoid surgery.

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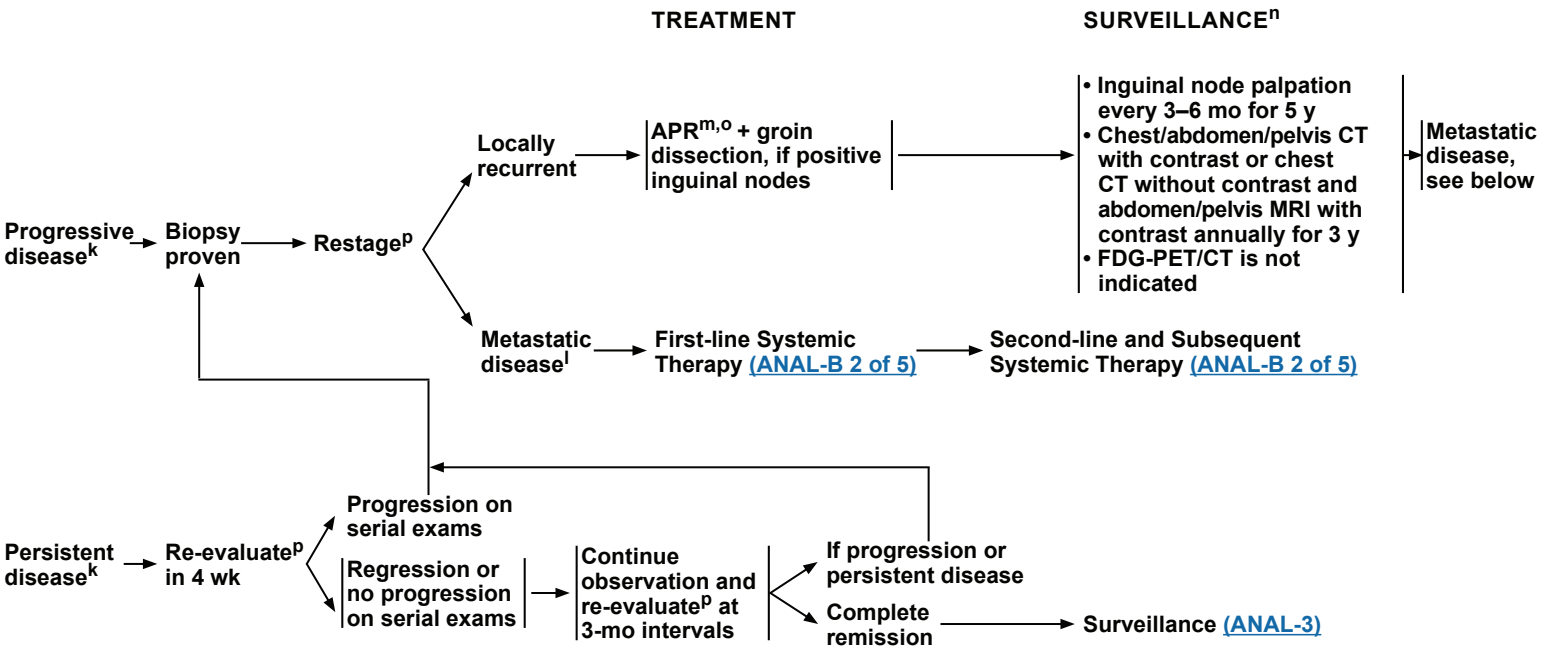

[k] Based on the results of the ACT-II study, it may be appropriate to follow patients who have not achieved a complete clinical response with persistent anal cancer up to 6 months following completion of RT and chemotherapy as long as there is no evidence of progressive disease during this period of follow-up. Persistent disease may continue to regress even at 26 weeks from the start of treatment. James RD, et al. Lancet Oncol 2013;14:516-524.

[l] Palliative RT may be considered in symptomatic patients. Records of previous RT should be carefully reviewed and considered prior to potential re-irradiation of previously irradiated fields. See Principles of Radiation Therapy (ANAL-C).

[m] Consider muscle flap reconstruction.

[n] Principles of Survivorship (ANAL-D).

[o] Consider the use of immunotherapy (nivolumab, pembrolizumab, retifanlimab-dlwr, cemiplimab-rwlc, dostarlimab-gxly, tislelizumab-jsgr, or toripalimab-tpzi) (category 2B) before proceeding to APR. Institutional experience has demonstrated that some patients receive a good response and can avoid surgery.

[p] Use imaging studies as per initial workup.

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PRINCIPLES OF SURGERY

Local Excision

- **Superficially Invasive Squamous Cell Carcinoma (SISCCA)**
  - **SISCCA are anal cancers that are generally found incidentally in the setting of a biopsy or excision of what is thought to be a benign lesion such as a condyloma, hemorrhoid, or anal skin tag.**
  - **For such lesions that are noted to have histologically negative margins in carefully selected patients followed by an experienced provider and/or team, local excision alone with a structured surveillance plan may represent adequate treatment.**
- **Perianal (Anal Margin) Cancer**
  - **T1N0, moderately to well-differentiated or select T2N0 squamous cell carcinoma (SCC) of the perianal (anal margin) region may be adequately treated by local excision with 1-cm margins.**
    - ◊ **Local surgical excision of select, early lesions may be considered:**
      - **– Where the tumor forms a discrete lesion arising from the perianal skin that is clearly separate from the anal canal**
      - **– Where negative margin excision can be accomplished without compromise of the adjacent sphincter muscles**
      - **– Where there is no evidence of regional nodal involvement**

Radical Surgery

- **Local Recurrence/Persistence**
  - **APR is the primary treatment.**
  - **General principles for APR are similar to those for distal rectal cancer and include the incorporation of total mesorectal excision (TME).**
  - **APR for anal cancer may require wider lateral perianal margins.**
  - **Due to the necessary exposure of the perineum to radiation, patients are prone to poor perineal wound healing and may benefit from the use of reconstructive tissue flaps for the perineum such as the vertical rectus or local myocutaneous flaps.**
- **Inguinal Recurrence**
  - **Patients who have already received groin radiation should undergo an inguinal node dissection.**
  - **Groin dissection can be done with or without APR depending on whether disease is isolated to the groin or is in conjunction with recurrence/persistence at the primary site.**

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PRINCIPLES OF SYSTEMIC THERAPY – LOCALIZED CANCER

Chemo/RT for Localized Cancer	
Preferred Regimens	**Other Recommended Regimens**
• 5-FU + mitomycin + RT • Capecitabine + mitomycin + RT	• 5-FU + cisplatin + RT (category 2B)

Systemic Therapy Regimens and Dosing – Localized Cancer

- 5-FU + mitomycin + RT[1,2]
  - Continuous infusion 5-FU 1000 mg/m^2/day IV days 1–4 and 29–32
    Mitomycin 10 mg/m^2 IV bolus days 1 and 29 (capped at 20 mg) with RT
    or
  - Continuous infusion 5-FU 1000 mg/m^2/day IV days 1–4 and 29–32
    Mitomycin 12 mg/m^2 IV bolus day 1 (capped at 20 mg) with RT

- Capecitabine + mitomycin + RT[3,4]
  - Capecitabine 825 mg/m^2 PO BID Monday–Friday, on days of radiation treatment only, throughout the duration of RT (typically 28–30 treatment days)
    Mitomycin 10 mg/m^2 IV bolus days 1 and 29 (capped at 20 mg) with RT
    or
  - Capecitabine 825 mg/m^2 PO BID Monday–Friday, on days of radiation treatment only, throughout the duration of RT (typically 28–30 treatment days)
    Mitomycin 12 mg/m^2 IV bolus day 1 (capped at 20 mg) with RT

- 5-FU + cisplatin + RT[5]
  - Cisplatin 75 mg/m^2 IV day 1
    Continuous infusion 5-FU 1000 mg/m^2/day IV days 1–4
    Repeat every 4 weeks with RT

References on ANAL-B 4 of 5

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PRINCIPLES OF SYSTEMIC THERAPY – METASTATIC CANCER

First-Line Therapy	
Preferred Regimens	**Other Recommended Regimens**
• Carboplatin + paclitaxel	• FOLFCIS • mFOLFOX6[a] • 5-FU + cisplatin (category 2B) • Carboplatin + paclitaxel + retifanlimab-dlwr (category 2B) • Modified docetaxel/cisplatin/fluorouracil (DCF) (category 2B)

Chemo/RT to the Primary Site for Local Control
• 5-FU + RT • Capecitabine + RT

Second-Line and Subsequent Therapy	
Preferred Regimens (if no prior immunotherapy received)[b]	**Other Recommended Regimens** (if not previously given)
• Cemiplimab-rwlc • Dostarlimab-gxly • Nivolumab • Pembrolizumab • Retifanlimab-dlwr • Tislelizumab-jsgr • Toripalimab-tpzi	• Carboplatin + paclitaxel • FOLFCIS • mFOLFOX6[a] • 5-FU + cisplatin (category 2B) • Modified DCF (category 2B)

Regimens and Dosing on ANAL-B 3 of 5

[a] Discontinuation of oxaliplatin should be strongly considered after 3 to 4 months of therapy (or sooner for unacceptable neurotoxicity) while maintaining other agents until time of progression. Oxaliplatin may be reintroduced if it was discontinued for neurotoxicity rather than for disease progression.
[b] NCCN Guidelines for the Management of Immunotherapy-Related Toxicities.

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PRINCIPLES OF SYSTEMIC THERAPY – METASTATIC CANCER

Systemic Therapy Regimens and Dosing – Metastatic Cancer

- **Carboplatin + paclitaxel**
  - **Carboplatin AUC 5 IV day 1**
    Paclitaxel 175 mg/m² IV day 1
    Repeat every 21 days[6]
    or
  - **Carboplatin AUC 5 IV day 1**
    Paclitaxel 80 mg/m² IV days 1, 8, 15
    Repeat every 28 days[7]

- **FOLFCIS[8]**
  Cisplatin 40 mg/m² IV over 30 minutes on day 1*
  Leucovorin 400 mg/m² IV day 1*
  5-FU 400 mg/m² IV bolus day 1,
  then 1000 mg/m²/day x 2 days
  (total 2000 mg/m² over 46–48 hours)
  IV continuous infusion
  Repeat every 2 weeks
  *Cisplatin and leucovorin are given concurrently

- **mFOLFOX6[9]**
  Oxaliplatin 85 mg/m² IV day 1
  Leucovorin 400 mg/m² IV day 1
  5-FU 400 mg/m² IV bolus day 1,
  then 1200 mg/m²/day x 2 days
  (total 2400 mg/m² over 46–48 hours)
  IV continuous infusion
  Repeat every 2 weeks

- **5-FU + cisplatin**
  - **Cisplatin 60 mg/m² IV day 1**
    Continuous infusion 5-FU 1000 mg/m²/day
    IV days 1–4
    Repeat every 3 weeks[10]
    or
  - **Cisplatin 75 mg/m² IV day 1**
    Continuous infusion 5-FU 750 mg/m²/day
    IV days 1–5
    Repeat every 4 weeks[11]

- **Carboplatin + paclitaxel + retifanlimab-dlwr[12]**
  Carboplatin AUC 5 IV day 1
  Paclitaxel 80 mg/m² IV days 1, 8, and 15
  Retifanlimab-dlwr 500 mg IV day 1
  Repeat every 28 days for 6 cycles
  Followed by retifanlimab-dlwr 500 mg IV day 1
  Repeat every 28 days for up to 7 cycles

- **Modified DCF[13]**
  Docetaxel 40 mg/m² IV day 1
  Cisplatin 40 mg/m² IV day 1
  Fluorouracil 1200 mg/m²/day x 2 days
  (total 2400 mg/m² over 46–48 hours)
  Repeat every 2 weeks

- **Cemiplimab-rwlc[14,15]**
  350 mg IV day 1
  Repeat every 3 weeks

- **Dostarlimab-gxly[16]**
  Dostarlimab-gxly 500 mg IV every 3 weeks for 4 doses followed by 1000 mg IV every 6 weeks

- **Nivolumab[17]**
  Nivolumab 240 mg IV every 2 weeks
  or Nivolumab 3 mg/kg IV every 2 weeks
  or Nivolumab 480 mg IV every 4 weeks

- **Pembrolizumab[18]**
  Pembrolizumab 200 mg IV every 3 weeks
  or Pembrolizumab 2 mg/kg IV every 3 weeks
  or Pembrolizumab 400 mg IV every 6 weeks

- **Retifanlimab-dlwr[19]**
  500 mg IV on day 1
  Repeat every 4 weeks

- **Tislelizumab-jsgr[20-23]**
  200 mg IV day 1
  Repeat every 3 weeks

- **Toripalimab-tpzi[24,25]**
  3 mg/kg IV day 1
  Repeat every 2 weeks

Chemo/RT

- **5-FU + RT**
  - **5-FU 225 mg/m² IV over 24 hours (continuous infusion) daily on days 1–5 or 1–7 for 5 weeks with RT[26-28]**

- **Capecitabine + RT**
  - **Capecitabine 825 mg/m² PO twice daily Monday–Friday, on days of radiation treatment only, throughout the duration of RT (typically 28–30 treatment days)[29-31]**

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PRINCIPLES OF SYSTEMIC THERAPY
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2 James RD, Glynne-Jones R, Meadows HM, et al. Mitomycin or cisplatin chemoradiation with or without maintenance chemotherapy for treatment of squamous cell carcinoma of the anus (ACT II): a randomised, phase 3, open-label, 2 x 2 factorial trial. Lancet Oncol 2013;14:516-524.

3 Goodman KA, Julie D, Cercek A, et al. Capecitabine with mitomycin reduces acute hematologic toxicity and treatment delays in patients undergoing definitive chemoradiation using intensity modulated radiation therapy for anal cancer. Int J Radiat Oncol Biol Phys 2017;98:1087-1095.

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PRINCIPLES OF SYSTEMIC THERAPY
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PRINCIPLES OF RADIATION THERAPY[1]

General Principles

- **The consensus of the Panel is that intensity-modulated RT (IMRT) is preferred over 3D conformal RT (3D-CRT) in the treatment of anal carcinoma.[2] IMRT requires expertise and careful target design to avoid reduction in local control by so-called "marginal-miss."[3] The clinical target volumes (CTVs) for anal cancer used in the RTOG-0529 trial have been described in detail.[2] The outcome results of RTOG-0529 have been reported.[4] Also see The RTOG Consensus Panel Contouring Atlas for more details of the contouring atlas defined by RTOG. The information below provides details regarding simulation, target volume definition, dose prescription, organs at risk (OAR), IMRT constraints, quality assurance, and image guidance delivery.**
- **Image-guided RT (IGRT) with kilovoltage (kV) imaging or cone beam CT imaging should be routinely used during the course of treatment with IMRT and stereotactic body RT (SBRT).**
- **Consider SBRT for patients with oligometastatic disease.**

Treatment Information

- **Simulation**
  - **After clinical and radiologic staging, CT-based simulation is performed for radiation treatment planning. If available, FDG-PET/CT, MRI pelvis, or FDG-PET/MRI (if available) at the time of simulation may be helpful to define local and regional target structures. Patients can be simulated in the supine or prone position and there are benefits to each approach in the appropriate clinical setting. Prone setup with a false tabletop allows for improved small bowel avoidance and may be useful in individuals with a large pannus and pelvic node involvement. Supine setup is usually more reproducible with less setup variability, potentially allowing for reduced planning target volume (PTV) margins and smaller treatment fields. Patients are typically simulated for anal cancer IMRT planning in the supine position with legs slightly abducted (frog-legged) with semi-rigid immobilization in vacuum-locked bag or alpha-cradle. Patients are instructed to maintain a full bladder for simulation and treatment.**
  - **In males,* the external genitalia are typically positioned inferiorly such that setup is reproducible. In females,* a vaginal dilator can be placed to help delineate the genitalia and move the vulva and lower vagina away from the primary tumor. A radiopaque marker should be placed at the anal verge and perianal skin involvement can be outlined with radio-opaque catheters. It may be helpful to place a catheter with rectal contrast in the anal canal at the time of simulation for tumor delineation.**
  - **In patients with adequate renal function, IV contrast facilitates identification of the pelvic and groin vasculature (which approximates at-risk nodal regions). Oral contrast identifies small bowel as an avoidance structure during treatment planning. For tumors involving the perianal skin or superficial inguinal nodes, bolus should be placed as necessary for adequate dosing of gross disease in these areas. Routine use of bolus may not be necessary as the tangential effect of IMRT may minimize skin sparing. In situations where adequate dosing of superficial targets is uncertain, in vivo diode dosimetry with the first treatment fraction can ensure appropriate dose at the skin surface.**

* NCCN recommendations have been developed to be inclusive of individuals of all sexual and gender identities to the greatest extent possible. On this page, the terms males and females refer to sex assigned at birth.

[1] Ajani JA, Winter KA, Gunderson LL, et al. Fluorouracil, mitomycin, and radiotherapy vs fluorouracil, cisplatin, and radiotherapy for carcinoma of the anal canal: a randomized controlled trial. JAMA 2008;299:1914-1921.
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PRINCIPLES OF RADIATION THERAPY[1]

Treatment Information (continued)

- **Target Volume Definition**
  - **Target volume definition should be performed per ICRU 50 recommendations. Gross tumor volume (GTV) should include all primary tumor and involved lymph nodes, using information from physical examination, endoscopic findings, diagnostic imaging, and simulation planning study for delineation. CTV should include the GTV plus areas at risk for microscopic spread from the primary tumor and at-risk nodal areas. If the primary tumor cannot be determined with available information (such as after local excision), the anal canal may be used as a surrogate target.**
  - **The pelvic and inguinal nodes should be routinely treated in all patients.**
  - **When using IMRT, a separate CTV volume for each planned treatment dose tier is contoured. One approach has been to define three tiers: a gross disease only volume, a high-risk elective nodal volume (including gross disease), and low-risk elective nodal volume (including gross disease). These volumes are determined by the presence or absence of tumor based on physical examination, biopsy, diagnostic and planning studies, and risk of nodal spread depending on tumor stage at presentation. The rationale for this approach is based on the shrinking fields technique. In RTOG-0529, a gross disease volume with a single elective nodal volume are used to deliver the prescribed course (dose-painting).**
  - **In defining the gross disease CTV around the primary tumor, an approximately 1- to 2-cm margin around GTV should be used with manual editing to avoid muscle or bone at low risk for tumor infiltration. To define the gross disease CTV around involved nodes, a 0.5- to 1-cm expansion should be made beyond the contoured involved lymph node with manual editing to exclude areas at low risk for tumor infiltration.**
  - **At-risk nodal regions include mesorectal, presacral, internal and external iliac, and inguinal nodes. The mesorectal volume encompasses the rectum and surrounding lymphatic tissue. The presacral nodal volume is typically defined as an approximately 1-cm strip over the anterior sacral prominence. To contour the internal and external iliac nodes, it is recommended to generally contour the iliac arteries and veins with approximately 0.7-cm margin (1- to 1.5-cm anteriorly on external iliac vessels) to include adjacent lymph nodes. In order to include the obturator lymph nodes, external and internal iliac volume contours should be joined parallel to the pelvic sidewall. The inguinal node volume extends beyond the external iliac contour along the femoral artery from approximately the upper edge of the superior pubic rami to approximately 2 cm caudad to saphenous/femoral artery junction. The inguinal node volume should be contoured as a compartment with general margins. The medial and lateral borders may be defined by adductor longus and sartorius muscles, respectively. Several recently published atlases are helpful to review when defining elective nodal CTVs.[5,6] The above descriptions are generalizations and each plan should be individualized based on the anatomy of each patient and tumor distribution.**

[1] Ajani JA, Winter KA, Gunderson LL, et al. Fluorouracil, mitomycin, and radiotherapy vs fluorouracil, cisplatin, and radiotherapy for carcinoma of the anal canal: a randomized controlled trial. JAMA 2008;299:1914-1921.
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PRINCIPLES OF RADIATION THERAPY[1]

Treatment Information (continued)

- **Target Volume Definition**
  - **The high-risk elective nodal volume typically includes the gross disease CTV plus the entire mesorectum, presacral nodes, and bilateral internal and external iliac lymph nodes inferior to the sacroiliac joint. In patients with gross inguinal nodal involvement, the bilateral or unilateral inguinal nodes may be included in the high-risk elective nodal volume. The low-risk elective nodal volume should include the gross disease CTV, high-risk elective nodal CTV, and presacral, bilateral internal, and external iliac nodes above the inferior border of the sacroiliac joint to the bifurcation of the internal and external iliac vessels at approximately L5/S1 vertebral body junction. If there is no obvious involvement of the bilateral inguinal nodes, these are included in the low-risk elective nodal volume.**
  - **PTV should account for effects of organ and patient movement and inaccuracies in beam and patient setup. PTV expansions should typically be approximately 0.5- to 1.0-cm depending on use of image guidance and physician practice with treatment setup for each defined CTV. To account for differences in bladder and rectal filling, a more generous CTV to PTV margin is applied in these regions. These volumes may be manually edited to limit the borders to the skin surface for treatment planning purposes.**
- **Dose Prescription**
  - **With IMRT treatment planning, doses are typically prescribed to PTVs. The dose of radiation required to control disease is extrapolated from historical studies that show excellent rates of control with concurrent radiation and chemotherapy. Typically prescribed dose varies by size of the tumor and risk of microscopic spread in elective nodal areas. One approach with "shrinking field technique" is that the low-risk elective nodal PTV volume is typically prescribed to 30.6 Gy in 1.8 Gy daily fractions. The high-risk elective nodal PTV is sequentially prescribed an additional 14.4 Gy in 1.8 Gy daily fractions for a total prescribed dose of 45 Gy. Finally, for T1–2 lesions with residual disease after 45 Gy, T3–4 lesions, or N1 lesions, an additional 5.4–14.4 Gy in 1.8–2 Gy daily fractions is again sequentially prescribed to the gross disease PTV volume (total dose, 50.4–59.4 Gy).**
  - **In RTOG-0529, the prescription parameters are different due to the use of only a single elective nodal volume and slightly different dose prescriptions depending on tumor stage. Furthermore, delivery of escalating dose to different target volumes was performed using a simultaneous integrated boost (SIB) dose painting technique with a maximum dose of 1.8 Gy per fraction to the primary tumor and large volume gross nodal involvement and 1.5 Gy per daily fraction to elective nodal areas. Table 1 outlines dose prescriptions by TNM stage according to the RTOG-0529 protocol. The SIB approach offers the convenience of developing a single treatment plan with reduced planning complexity, albeit with a lower biological dose delivered to the elective nodal areas.**
  - **For patients untreated presenting with synchronous local and metastatic disease, a platinum-based regimen is standard practice, and radiation can be considered for local control. The approach to radiation depends on the patient's performance status and extent of metastatic disease. If performance status is good and metastatic disease is limited, treat involved fields, 45–54 Gy to the primary tumor and involved sites in the pelvis, in coordination with plans for a platinum-based regimen. If there is low-volume liver oligometastasis, an SBRT dosing schema after systemic therapy may be appropriate depending on response. If metastatic disease is extensive and life expectancy is limited, a different schedule and dose of radiation should be considered, again in coordination with plans for 5-FU/cisplatin or a platinum-based regimen.**

[1] Ajani JA, Winter KA, Gunderson LL, et al. Fluorouracil, mitomycin, and radiotherapy vs fluorouracil, cisplatin, and radiotherapy for carcinoma of the anal canal: a randomized controlled trial. JAMA 2008;299:1914-1921.

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PRINCIPLES OF RADIATION THERAPY[1]

Treatment Information (continued)

Table 1: Dose Specification of Primary and Nodal Planning Target Volumes: RTOG-0529[4]

TNM Stage	Primary Tumor PTV Dose	Involved Nodal PTV Dose	Nodal PTV Dose
T1, N0	50.4 Gy (28 fxs at 1.8 Gy/fx)	N/A	42 Gy (28 fxs at 1.5 Gy/fx)
T2, N0	50.4 Gy (28 fxs at 1.8 Gy/fx)	N/A	42 Gy (28 fxs at 1.5 Gy/fx)
T3–4, N0	54 Gy (30 fxs at 1.8 Gy/fx)	N/A	45 Gy (30 fxs at 1.5 Gy/fx)
T any, N+ (≤3 cm)	54 Gy (30 fxs at 1.8 Gy/fx)	50.4 Gy (30 fxs at 1.68 Gy/fx)	45 Gy (30 fxs at 1.5 Gy/fx)
T any, N+ (>3 cm)	54 Gy (30 fxs at 1.8 Gy/fx)	54 Gy (30 fxs at 1.8 Gy/fx)	45 Gy (30 fxs at 1.5 Gy/fx)

- **Dose Prescription**
  - **The usual scenario of recurrent disease is recurrence in the primary site or nodes after previous RT and chemotherapy. In this setting, surgery should be performed if possible, and, if not, palliative RT and chemotherapy can be considered based on symptoms, extent of recurrence, and prior treatment. RT technique and doses are dependent on dosing and technique of prior treatment. In the setting of pure palliation, doses of 20–25 Gy in 5 fractions to 30 Gy in 10 fractions can be considered. SBRT can also be considered for treatment of primary and nodal recurrence in the setting of low-volume metastatic disease.**
- **OARs and IMRT Constraints**
  - **It is important to accurately define OARs so that dose to these structures can be minimized during treatment. In anal cancer, 2D and 3D treatment planning techniques are limited in their ability to spare most pelvic normal tissues due to the location of the target. With IMRT, dose to small bowel, bladder, pelvic/femoral bones, and external genitalia can be sculpted and minimized despite close proximity of these organs to target volumes. When contouring these structures, it is typically best to demarcate normal tissues on axial CT at least 2 cm above and below the PTV. Oral contrast is helpful to delineate the small bowel. While there is significant variability in how to contour the small bowel, one approach entails contouring the entire volume of peritoneal space in which the small bowel can move. As with elective nodal volume delineation, contouring atlases offer excellent guidance on defining OARs.[7] Once the OARs have been identified, the chief aim of IMRT planning is to limit the dose to these structures without compromising PTV coverage. The extent to which OARs can be avoided largely depends on the location and extent of tumor involvement at presentation as well as the extent to which the bowel extends into the lower pelvis and a given individual's anatomy.**
  - **Given patient variation with respect to OAR position and areas of tumor involvement, practical dose constraint guidelines are challenging. In tumors without gross nodal involvement it is often possible to limit OAR doses even further. Alternatively, in tumors with gross nodal involvement within the pelvis, compromise of PTV coverage may be necessary to limit doses to normal tissues, such as small bowel. Table 2 outlines dose constraints in RTOG-0529.**

[1] Ajani JA, Winter KA, Gunderson LL, et al. Fluorouracil, mitomycin, and radiotherapy vs fluorouracil, cisplatin, and radiotherapy for carcinoma of the anal canal: a randomized controlled trial. JAMA 2008;299:1914-1921.
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PRINCIPLES OF RADIATION THERAPY[1]

Treatment Information (continued)

Table 2: DP-IMRT Dose Constraints for Normal Tissues[8]

Organ	Dose (Gy) at <5% Volume	Dose (Gy) at <35% Volume	Dose (Gy) at <50% Volume
Small bowel†	45 (<20 cc)	35 (<150 cc)	30 (<200 cc)
Femoral heads	44	40	30
Iliac crest	50	40	30
External genitalia	40	30	20
Bladder	50	40	35
Large bowel†	45 (<20 cc)	35 (<150 cc)	30 (<200 cc)

Organs are listed in order of decreasing priority.
†Dose constraints are based on absolute volume instead of % volume.

- **Quality Assurance and Image-Guided Treatment Delivery**
  - **Due to the sophistication and complexity of IMRT planning for anal cancer, comprehensive quality assurance measures must be implemented to ensure minimal variability between the designed and delivered treatment plans. Each institution should have a quality assurance program in place for the treatment of patients with anal cancer.**
  - **The use of image guidance for radiation treatment delivery has significantly improved confidence in daily treatment setup. This has allowed for shrinking CTV to PTV expansions during the treatment planning process, which in turn further minimizes dose to OARs.**
  - **If it is not possible to achieve the dosimetric goals in Table 2, small bowel max point dose should be limited to Dmax 55 Gy, V45 should be ≤150 cc for a bowel bag avoidance structure, and V50 should be ≤30 cc for individual small bowel loops.[9,10]**
- **Supportive Care**
  - **Patients should be considered for vaginal dilators and instructed on the symptoms of vaginal stenosis.**
  - **Patients of childbearing potential should be counseled about the effects of premature menopause and consideration should be given to referral for discussion of hormone replacement strategies.**
  - **Patients of childbearing potential should be counseled that an irradiated uterus cannot carry a fetus to term.**
  - **Patients should be counseled on sexual dysfunction, potential for future low testosterone levels, and infertility risks and given information regarding sperm banking or oocyte, egg, or ovarian tissue banking, as appropriate, prior to treatment.**

[1] Ajani JA, Winter KA, Gunderson LL, et al. Fluorouracil, mitomycin, and radiotherapy vs fluorouracil, cisplatin, and radiotherapy for carcinoma of the anal canal: a randomized controlled trial. JAMA 2008;299:1914-1921.
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PRINCIPLES OF SURVIVORSHIP

Anal Carcinoma Surveillance:
- Long-term surveillance should be carefully managed with routine good medical care and monitoring, including cancer screening, routine health care, and preventive care.

Survivorship Care Planning:
The oncologist and primary care provider should have defined roles in the surveillance period, with roles communicated to the patient.[1]
- Develop survivorship care plan that includes:
  - Overall summary of treatment, including all surgeries, radiation treatments, and chemotherapy received.
  - Description of possible expected time to resolution of acute toxicities, long-term effects of treatment, and possible late sequelae of treatment.
  - Surveillance recommendations.
  - Delineation of appropriate timing of transfer of care with specific responsibilities identified for primary care physician and oncologist.
  - Health behavior recommendations.
  - Fertility counseling.

Management of Late/Long-term Sequelae of Disease or Treatment[2-6]:
- For issues related to distress, pain, neuropathy, fatigue, or sexual dysfunction, see NCCN Guidelines for Survivorship.
- Bowel function changes: chronic diarrhea, incontinence, stool frequency, stool clustering, urgency, and/or cramping
  - Consider anti-diarrheal agents, bulk-forming agents, diet manipulation, pelvic floor rehabilitation, and protective undergarments.
  - Management of an ostomy
    - Consider participation in an ostomy support group or coordination of care with a health care provider specializing in ostomy care (ie, ostomy nurse).
    - Screen for distress around body changes (NCCN Guidelines for Distress Management) and precautions around involvement with physical activity (SPA-A in the NCCN Guidelines for Survivorship).
- Urogenital dysfunction after resection and/or pelvic radiation[7,8]
  - Screen for sexual dysfunction, erectile dysfunction, dyspareunia, vaginal stenosis, and vaginal dryness.
  - Screen for urinary incontinence, frequency, and urgency.
  - Consider referral to urologist or gynecologist for persistent symptoms.
- Potential for pelvic fractures/decreased bone density after pelvic radiation
  - Consider bone density monitoring.

Counseling Regarding Healthy Lifestyle and Wellness[9]:
NCCN Guidelines for Survivorship
- Undergo all age- and gender-appropriate cancer and preventive health screenings as per national guidelines.
- Maintain a healthy body weight throughout life.
- Adopt a physically active lifestyle (at least 30 minutes of moderate-intensity activity on most days of the week). Activity recommendations may require modification based on treatment sequelae (ie, ostomy, neuropathy).
- Consume a healthy diet with an emphasis on plant sources. Diet recommendations may be modified based on severity of bowel dysfunction.
- Drink alcohol sparingly, if at all.
- Seek smoking cessation counseling as appropriate.

Additional health monitoring and immunizations should be performed as indicated under the care of a primary care physician. Survivors are encouraged to maintain a therapeutic relationship with a primary care physician throughout their lifetime.

References on ANAL-D 2 of 2

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PRINCIPLES OF SURVIVORSHIP
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American Joint Committee on Cancer (AJCC)
TNM Staging Classification for Anal Carcinoma (9th ed., 2022)
***Table 1*. Definitions for T, N, M**

T	**Primary Tumor**
TX	Primary tumor not assessed
T0	No evidence of primary tumor
T1	Tumor less than or equal to 2 cm in greatest dimension
T2	Tumor greater than 2 cm but less than or equal to 5 cm in greatest dimension
T3	Tumor greater than 5 cm in greatest dimension
T4	Tumor of any size invades adjacent organ(s), such as the vagina, urethra, or bladder

N	**Regional Lymph Nodes**
NX	Regional lymph nodes cannot be assessed
N0	No tumor involvement of regional lymph node(s)
N1	Tumor involvement of regional lymph node(s)
N1a	Tumor involvement of inguinal, mesorectal, superior rectal, internal iliac, or obturator lymph node(s)
N1b	Tumor involvement of external iliac lymph node(s)
N1c	Tumor involvement of N1b (external iliac) with any N1a node(s)

M	**Distant Metastasis**
cM0	No distant metastasis
cM1	Distant metastasis
pM1	Microscopic confirmation of distant metastasis

***Table 2*. AJCC Anatomic Stage/Prognostic Groups**

	T	**N**	**M**
Stage I	T1	N0	M0
Stage IIA	T2	N0	M0
Stage IIB	T1-T2	N1	M0
Stage IIIA	T3	N0-N1	M0
Stage IIIB	T4	N0	M0
Stage IIIC	T4	N1	M0
Stage IV	Any T	Any N	M1

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ABBREVIATIONS

APR	**abdominoperineal resection**
AUC	**area under the curve**
CTV	**clinical target volume**
DRE	**digital rectal examination**
FNA	**fine-needle aspiration**
GBCA	**gadolinium-based contrast agent**
GTV	**gross tumor volume**
HIV	**human immunodeficiency virus**
IGRT	**image-guided radiation therapy**
IMRT	**intensity-modulated radiation therapy**
OAR	**organ(s) at risk**
PTV	**planning target volume**
SBRT	**stereotactic body radiation therapy**
SCC	**squamous cell carcinoma**
SIB	**simultaneous integrated boost**
SISCCA	**superficially invasive squamous cell carcinoma**
TME	**total mesorectal excision**
3D-CRT	**three-dimensional conformal radiation therapy**

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NCCN Categories of Evidence and Consensus	
Category 1	Based upon high-level evidence (≥1 randomized phase 3 trials or high-quality, robust meta-analyses), there is uniform NCCN consensus (≥85% support of the Panel) that the intervention is appropriate.
Category 2A	Based upon lower-level evidence, there is uniform NCCN consensus (≥85% support of the Panel) that the intervention is appropriate.
Category 2B	Based upon lower-level evidence, there is NCCN consensus (≥50%, but <85% support of the Panel) that the intervention is appropriate.
Category 3	Based upon any level of evidence, there is major NCCN disagreement that the intervention is appropriate.

All recommendations are category 2A unless otherwise indicated.

NCCN Categories of Preference	
Preferred intervention	Interventions that are based on superior efficacy, safety, and evidence; and, when appropriate, affordability.
Other recommended intervention	Other interventions that may be somewhat less efficacious, more toxic, or based on less mature data; or significantly less affordable for similar outcomes.
Useful in certain circumstances	Other interventions that may be used for selected patient populations (defined with recommendation).

All recommendations are considered appropriate.

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Discussion

This discussion corresponds to the NCCN Guidelines for Anal Carcinoma. Last updated September 12, 2023

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Overview

An estimated 9760 new cases (3180 male and 6580 female) of anal cancer involving the anus, anal canal, or anorectum will occur in the United States in 2023, accounting for approximately 2.8% of digestive system cancers.[1] 1870 deaths due to anal cancer are projected to occur in the United States in 2023.[1] Although considered to be a rare cancer, the incidence rate of invasive anal carcinoma in the United States increased by approximately 1.9-fold for males and 1.5-fold for females between the periods of 1973–1979 to 1994–2000 and has continued to increase since that time.[2-4] According to an analysis of SEER data, the incidence of anal squamous carcinoma increased at a rate of 2.9% per year from 1992 to 2001.[5] Supporting this, an analysis of the U.S. Cancer Statistics dataset reported an annual increase of 2.7% between 2001 to 2015 with the greatest increases in age groups ≥50 years,[6] while the National Program of Cancer Registries and SEER programs showed similar trends from 2001 to 2016, with an annual percent change of 2.1 (95% CI, 1.7–2.5) overall, and 2.8 (95% CI, 2.5–3.1) in those ≥50 years of age.[7] Increases in incidence of anal cancer during that time frame were especially noted for females ≥50 years. Anal cancer mortality rates (2001–2016) also rose, with an average increase of 3.1% per year.[6]

This Discussion summarizes the NCCN Clinical Practice Guidelines for managing squamous cell anal carcinoma, which represents the most common histologic form of the disease. Other groups have also published guidelines for the management of anal squamous cell carcinoma.[8-10] Other types of cancers occurring in the anal region are addressed in other NCCN Guidelines; anal adenocarcinoma and anal melanoma are managed according to the NCCN Clinical Practice Guidelines (NCCN Guidelines®) Rectal Cancer and the NCCN Guidelines® for Melanoma, respectively.

Guidelines Update Methodology

The complete details of the Development and Update of the NCCN Guidelines are available at www.NCCN.org.

Literature Search Criteria

Prior to the update of this version of the NCCN Guidelines for Anal Carcinoma, an electronic search of the PubMed database was performed to obtain key literature in the field of anal cancer published since the previous Guidelines update, using the search terms: anal cancer or anal squamous cell carcinoma. The PubMed database was chosen because it remains the most widely used resource for medical literature and indexes peer-reviewed biomedical literature.[11]

The search results were narrowed by selecting studies in humans published in English. Results were confined to the following article types: Clinical Trial, Phase II; Clinical Trial, Phase III; Clinical Trial, Phase IV; Practice Guideline; Randomized Controlled Trials; Meta-Analysis; Systematic Reviews; and Validation Studies. The data from key PubMed articles as well as articles from additional sources deemed as relevant to these Guidelines as discussed by the panel during the Guidelines update have been included in this version of the Discussion section. Recommendations for which high-level evidence is lacking are based on the panel's review of lower-level evidence and expert opinion.

Sensitive/Inclusive Language Usage

NCCN Guidelines strive to use language that advances the goals of equity, inclusion, and representation. NCCN Guidelines endeavor to use language that is person-first; not stigmatizing; anti-racist, anti-classist, anti-misogynist, anti-ageist, anti-ableist, and anti-weight-biased; and inclusive of individuals of all sexual orientations and gender identities. NCCN Guidelines incorporate non-gendered language, instead focusing on organ-specific recommendations. This language is both more

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accurate and more inclusive and can help fully address the needs of individuals of all sexual orientations and gender identities. NCCN Guidelines will continue to use the terms men, women, female, and male when citing statistics, recommendations, or data from organizations or sources that do not use inclusive terms. Most studies do not report how sex and gender data are collected and use these terms interchangeably or inconsistently. If sources do not differentiate gender from sex assigned at birth or organs present, the information is presumed to predominantly represent cisgender individuals. NCCN encourages researchers to collect more specific data in future studies and organizations to use more inclusive and accurate language in their future analyses.

Risk Factors

Anal carcinoma is associated with human papillomavirus (HPV) infection (anal-genital warts); a history of receptive anal intercourse or sexually transmitted disease; a history of cervical, vulvar, or vaginal cancer; immunosuppression after solid organ transplantation or human immunodeficiency virus (HIV) infection; hematologic malignancies; certain autoimmune disorders; and smoking.[12-20]

The association between anal carcinoma and persistent infection with a high-risk form of HPV (eg, HPV-16; HPV-18) is especially strong.[13,21,22] For example, a study of tumor specimens from more than 60 pathology laboratories in Denmark and Sweden showed that high-risk HPV DNA was detected in 84% of anal cancer specimens, with HPV-16 detected in 73% of them. In contrast, high-risk HPV was not detected in any of the rectal adenocarcinoma specimens analyzed.[13] In addition, results of a systematic review of 35 peer-reviewed anal cancer studies that included HPV DNA testing results published up until July 2007 showed the prevalence of HPV-16/18 to be 72% in patients with invasive anal cancer.[22] Population and registry studies have found similar HPV prevalence rates in anal cancer specimens.[23,24] A 2012 report from the U.S. Centers for Disease Control and Prevention (CDC) estimated that 86% to 97% of cancers of the anus are attributable to HPV infection.[25]

Suppression of the immune system by the use of immunosuppressive drugs or HIV infection likely facilitates persistence of HPV infection of the anal region.[26,27] Studies have shown that people living with HIV (PLWH) have an approximately 15- to 35-fold increased likelihood of being diagnosed with anal cancer compared with the general population.[28-31] In PLWH, the standardized incidence rate of anal carcinoma per 100,000 person-years in the United States, estimated to be 19.0 in 1992 through 1995, increased to 78.2 during 2000 through 2003.[27] This result likely reflects both the survival benefits of modern antiretroviral therapy (ART) and the lack of an impact of ART on the progression of anal cancer precursors. The incidence rate of anal cancer has been reported to be 131 per 100,000 person-years in males who have sex with males (MSM) with HIV in North America, and in the range of 3.9 to 30 per 100,000 person years in females living with HIV.[32,33] An analysis of the French Hospital Database on HIV showed a highly elevated risk of anal cancer in PLWH, including in those who were on therapy and whose CD4+ T-cell counts were high.[34] The data also revealed an increasing incidence of anal cancer in the PLWH population over time. However, some evidence suggests that prolonged ART (>24 months) may be associated with a decrease in the incidence of high-grade anal intraepithelial neoplasia (AIN).[35]

A meta-analysis of anal cancer incidence across risk groups found that the incidence of anal cancer in solid organ transplant recipients increased both by age and years since transplant.[20] Incidence rates rose from 0.0 and 3.1 per 100,000 person years in males and females >30 years to 13.4 and 25.9 per 100,000 person years in males and females ≥60 years. Years since transplant appeared to identify an even

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higher risk than age, with an incidence rate of 24.5 and 29.6 per 100,000 person years in males and females ≥10 years post-transplant, respectively. This study also assessed risk in patients with autoimmune diseases and found incidence rates of 10, 6, and 3 per 100,000 person years for patients with systemic lupus erythematosus, ulcerative colitis, and Crohn's disease, respectively.

Risk Reduction

High-grade AIN can be a precursor to anal cancer.[36-39] AIN can be identified by cytology, HPV testing, digital anorectal examination (DRE/DARE), high-resolution anoscopy, and biopsy.[40,41] A prospective cohort study of 550 MSM who were HIV-positive found the rate of conversion of high-grade AIN to anal cancer to be 18% (7/38) at a median follow-up of 2.3 years, despite treatment.[39] Recently, a large randomized controlled trial known as the ANCHOR Study compared topical or ablative treatment with active monitoring in 4459 PLWH with anal high-grade squamous intraepithelial lesions (HSIL).[42] With a median follow-up of 25.8 months, 9 cases of anal cancer were diagnosed in the treatment group compared to 21 cases in the active monitoring group. The rate of progression to anal cancer was 57% lower with treatment compared to active monitoring (95% CI, 6–80; P = .03). Progression from anal HSIL to cancer was 402/100,000 person-years among individuals whose HSIL was monitored without treatment, with a cumulative progression to cancer of 1.8% over 4 years. Given the relatively young median age of the participants of 51 years and an expected normal life expectancy, this progression rate could lead to a substantial cumulative risk of developing anal cancer in the absence of HSIL treatment.

Recommendations for screening for and treating anal HSIL as secondary prevention of anal cancer are evolving due to the ANCHOR trial results. Prior to the publication of ANCHOR, guidelines for the treatment of AIN have been developed by several groups, including the American Society of Colon and Rectal Surgeons (ASCRS).[43-46] Treatment recommendations vary widely because high-level evidence in the field was limited prior to ANCHOR.[43] Most participants in the ANCHOR Study were treated with office-based, targeted electrocautery, indicating that this approach could be considered as a first line of therapy.[42] An earlier randomized controlled trial in 246 MSM with HIV found that electrocautery was superior to both topical imiquimod and topical fluorouracil in the treatment of AIN overall.[47] The subgroup with perianal AIN, as opposed to intra-anal AIN, appeared to respond better to imiquimod. Regardless of treatment, recurrence rates were high, and careful follow-up is likely needed.

The benefits of screening for anal HSIL are potentially quite large.[45,48-53] Systematic reviews and meta-analyses have suggested that anal cytology is effective in detection of AIN, particularly for individuals at high-risk.[54-56] The optimal approach to screening remains an area of uncertainty, but it is likely that future approaches will include additional tests such as HPV. Additional discussion will also be needed as to whether the results of the ANCHOR Study in PLWH can be extrapolated to other groups at high risk for anal cancer.

HPV Immunization

A quadrivalent HPV vaccine is available and has been shown to be effective in preventing persistent cervical infection with HPV-6, -11, -16, or -18 as well as in preventing high-grade cervical intraepithelial neoplasia related to these strains of the virus.[57-59] The vaccine has also been shown to be efficacious in young males at preventing genital lesions associated with HPV-6, -11, -16, or -18 infection.[60] A substudy of a larger double-blind study assessed the efficacy of the vaccine for the prevention of AIN and anal cancer related to infection with HPV-6, -11, -16, or -18 in MSM.[61] In this study, 602 healthy MSM aged 16 to 26

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years were randomized to receive the vaccine or a placebo. While none of the participants in either arm developed anal cancer during the 3-year follow-up period, there were 5 cases of grade 2/3 AIN associated with one of the vaccine strains in the vaccine arm and 24 such cases in the placebo arm in the per-protocol population, giving an observed efficacy of 77.5% (95% CI, 39.6–93.3). Since high-grade AIN is known to have the ability to progress to anal cancer,[36-38] these results suggest that use of the quadrivalent HPV vaccine in MSM may reduce the risk of anal cancer in this population.

A bivalent HPV vaccine against HPV-16 and -18 is also available.[62] In a randomized, double-blind controlled trial of female patients in Costa Rica, the vaccine was 83.6% effective against initial anal HPV-16/18 infection (95% CI, 66.7–92.8).[63,64] It has also been shown to be effective at preventing high-grade cervical intraepithelial neoplasias in young people.[65] The effect on precancerous anal lesions has not yet been reported.

A 9-valent HPV vaccine is also now available, protecting against HPV-6, -11, -16, -18, -31, -33, -45, -52, and -58.[66] Targeting the additional strains over the quadrivalent vaccine is predicted to prevent an additional 464 cases of anal cancer annually.[67] This vaccine was compared to the quadrivalent vaccine in an international, randomized phase IIb–III study that included more than 14,000 female patients.[68] The 9-valent vaccine was noninferior to the quadrivalent vaccine for antibody response to HPV-6, -11, -16, and -18 and prevented infection and disease related to the other viral strains included in the vaccine. The calculated efficacy of the 9-valent vaccine was 96.7% (95% CI, 80.9–99.8) for the prevention of high-grade cervical, vulvar, or vaginal disease related to those strains.

The Advisory Committee on Immunization Practices (ACIP) recommends routine use of the 9-valent vaccine in children aged 11 and 12 years, as well as catch-up vaccination for individuals through 26 years of age who have not been previously vaccinated.[69-72] The American Academy of Pediatrics concurs with this vaccination schedule.[73] ASCO released a statement regarding HPV vaccination for cancer prevention with the goal of increasing vaccine update.[74] In 2018, the FDA expanded use of the 9-valent vaccine to include individuals aged 27 through 45 years,[75] and the ACIP voted in 2019 to recommend vaccination, based on shared clinical decision-making, for individuals in this age range who are not adequately vaccinated.

Anatomy/Histology

The anal region is comprised of the anal canal and the perianal region, dividing anal cancers into two categories. The anal canal is the more proximal portion of the anal region. The 9th Edition of the AJCC Cancer Staging Manual includes a definition of anal canal cancer as tumors that develop from mucosa that cannot be entirely seen when the buttocks are gently pressed.[76] The corresponding definition for perianal cancer is tumors that 1) arise within the skin distal to or at the squamous mucocutaneous junction; 2) can be visualized completely when the buttocks are gently pressed; and 3) are within 5 cm of the anus.[76] Various other definitions of the anal canal exist (ie, functional/surgical; anatomic; histologic) that are based on particular physical/anatomic landmarks or histologic characteristics.

Histologically, the mucosal lining of the anal canal is predominantly formed by squamous epithelium, in contrast to the mucosa of the rectum, which is lined with glandular epithelium.[15,77] The anal margin, on the other hand, is lined with skin. By the histologic definition, the most superior aspect of the anal canal is a 1- to 2-cm zone between the anal and rectal epithelium, which has rectal, urothelial, and squamous histologic characteristics.[15,77] The most inferior aspect of the anal canal, approximately at the anal verge, corresponds to the area where the

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mucosa, lined with modified squamous epithelium, transitions to an epidermis-lined anal margin.

The anatomic anal canal begins at the anorectal ring and extends to the anal verge (ie, squamous mucocutaneous junction with the perianal skin).[78]

Functionally, the anal canal is defined by the sphincter muscles. The superior border of the functional anal canal, separating it from the rectum, has been defined as the palpable upper border of the anal sphincter and puborectalis muscles of the anorectal ring. It is approximately 3 to 5 cm in length, and its inferior border starts at the anal verge, the lowermost edge of the sphincter muscles, corresponding to the introitus of the anal orifice.[15,77,79] The functional definition of the anal canal is primarily used in the radical surgical treatment of anal cancer and is used in these guidelines to differentiate between treatment options. The anal margin starts at the anal verge and includes the perianal skin over a 5- to 6-cm radius from the squamous mucocutaneous junction.[77] Tumors can involve both the anal canal and the anal margin.

Pathology

Most primary cancers of the anal canal are of squamous cell histology.[77] The second edition of the WHO classification system of anal carcinoma designated all squamous cell carcinoma variants of the anal canal as cloacogenic and identified subtypes as large-cell keratinizing, large-cell non-keratinizing (transitional), or basaloid.[80] It has been reported that squamous cell cancers in the more proximal region of the anal canal are more likely to be non-keratinizing and less differentiated.[15] However, the terms cloacogenic, transitional, keratinizing, and basaloid were removed from the third and fourth editions of the WHO classification system of anal canal carcinoma,[81,82] and all subtypes have been included under a single generic heading of squamous cell carcinoma.[76,81] Reasons for this change include the following: both cloacogenic (which is sometimes used interchangeably with the term basaloid) and transitional tumors are now considered to be non-keratinizing tumors; it has been reported that both keratinizing and non-keratinizing tumors have a similar natural history and prognosis[81]; and a mixture of cell types frequently characterize histologic specimens of squamous cell carcinomas of the anal canal.[77,81,83] No distinction between squamous anal canal tumors based on cell type has been made in these guidelines. Other less common anal canal tumors, not addressed in these guidelines, include adenocarcinomas in the rectal mucosa or the anal glands, small cell (anaplastic) carcinoma, undifferentiated cancers, and melanomas.[77]

Perianal squamous cell carcinomas are more likely than those of the anal canal to be well-differentiated and keratinizing large-cell types,[84] but they are not characterized in the guidelines according to cell type. The presence of skin appendages (eg, hair follicles, sweat glands) in perianal tumors can distinguish them from anal canal tumors. However, it is not always possible to distinguish between anal canal and perianal squamous cell carcinoma since tumors can involve both areas.

Lymph drainage of anal cancer tumors is dependent on the location of the tumor in the anal region: cancers in the perianal skin and the region of the anal canal distal to the dentate line drain mainly to the superficial inguinal nodes.[76,77] Lymph drainage at and proximal to the dentate line is directed toward the anorectal, perirectal, and paravertebral nodes and to some of the nodes of the internal iliac system. More proximal cancers drain to perirectal nodes and to nodes of the inferior mesenteric system. Therefore, distal anal cancers present with a higher incidence of inguinal node metastases. Because the lymphatic drainage systems throughout the anal canal are not isolated from each other, however, inguinal node metastases can occur in proximal anal cancer as well.[77]

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The College of American Pathologists publishes protocols for the pathologic examination and reporting of anal tumors following excision or transabdominal resection. The most recent updates were made in April 2020 and February 2020, respectively.[85,86]

Staging

The TNM staging system for anal canal cancer developed by the AJCC is detailed in the guidelines.[76] Because current recommendations for the primary treatment of anal canal cancer do not involve a surgical excision, most tumors are staged clinically with an emphasis on the size of the primary tumor as determined by direct examination and microscopic confirmation. A tumor biopsy is required. Rectal ultrasound to determine depth of tumor invasion is not used in the staging of anal cancer (see *Clinical Presentation/Evaluation*, below).

In the past, these guidelines have used the AJCC TNM skin cancer system for the staging of perianal cancer since the two types of cancers have a similar biology. However, the 7th edition of the AJCC Cancer Staging Manual included substantial changes to the cutaneous squamous cell carcinoma stagings,[87] making them much less appropriate for the staging of perianal cancers. Furthermore, many perianal cancers have involvement of the anal canal or have high-grade, pre-cancerous lesions in the anal canal. It is important to look for such anal canal involvement, particularly if conservative management (simple excision) is being contemplated. Many patients, particularly PLWH, could be significantly undertreated. For these reasons, these guidelines use the AJCC anus staging system for both anal canal and perianal tumors.

The prognosis of anal carcinoma is related to the size of the primary tumor and the presence of lymph node metastases.[15] According to the SEER database,[88] between 1999 and 2006, 50% of anal carcinomas were localized at initial diagnosis; these patients had an 80% 5-year survival rate. Approximately 29% of patients had anal carcinoma that had already spread to regional lymph nodes at diagnosis; these patients had a 60% 5-year survival rate. The 12% of patients presenting with distant metastasis demonstrated a 30.5% 5-year survival rate.[88] In a retrospective study of 270 patients treated for anal canal cancer with radiation therapy (RT) between 1980 and 1996, synchronous inguinal node metastasis was observed in 6.4% of patients with tumors staged as T1 or T2, and in 16% of patients with T3 or T4 tumors.[89] In patients with N2–3 disease, survival was related to T-stage rather than nodal involvement with respective 5-year survival rates of 72.7% and 39.9% for patients with T1–T2 and T3–T4 tumors; however, the number of patients involved in this analysis was small.[89] An analysis of more than 600 patients with non-metastatic anal carcinoma from the RTOG 98-11 trial also found that the tumor and node categories impacted clinical outcomes such as overall survival (OS), disease-free survival (DFS), and colostomy failure, with the worst prognoses for patients with T4,N0 and T3–4,N+ disease.[90]

By the 8th edition of AJCC Cancer Staging Manual, the former N2 and N3 categories by locations of positive nodes were removed. [91] New categories of N1a, N1b, and N1c were defined and then further refined in the 9th edition.[76] N1a now represents metastasis in inguinal, mesorectal, superior rectal, internal iliac, or obturator nodes. N1b represents metastasis in external iliac nodes. N1c represents metastasis in external iliac with any N1a nodes. However, initial therapy of anal cancer does not typically involve surgery, and the true lymph node status may not be determined accurately by clinical and radiologic evaluation. Fine-needle aspiration (FNA) biopsy of inguinal nodes can be considered if tumor metastasis to these nodes is suspected. In a series of patients with anal cancer who underwent an abdominoperineal resection (APR), it was noted that pelvic nodal metastases were often

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less than 0.5 cm,[92] suggesting that routine radiologic evaluation with CT and PET/CT scan may not be reliable in the determination of lymph node involvement (discussed in more detail in *Clinical Presentation/Evaluation*, below).

Prognostic Factors

Multivariate analysis of data from the RTOG 98-11 trial showed that male sex and positive lymph nodes were independent prognostic factors for DFS in patients with anal cancer treated with 5-FU and radiation and either mitomycin or cisplatin.[93] Male sex, positive nodes, and tumor size greater than 5 cm were independently prognostic for worse OS. A secondary analysis of this trial found that tumor diameter could also be prognostic for colostomy rate and time to colostomy.[94] These results are consistent with earlier analyses from the EORTC 22861 trial, which found male sex, lymph node involvement, and skin ulceration to be prognostic for worse survival and local control.[95] Similarly, multivariate analyses of data from the ACT I trial also showed that positive lymph nodes and male sex are prognostic indicators for higher local regional failure, anal cancer death, and lower OS.[96]

Data suggest that HPV- and/or p16-positivity are prognostic for improved OS in patients with anal carcinoma.[97-100] In a retrospective study of 143 tumor samples, p16-positivity was an independent prognostic factor for OS (hazard ratio [HR], 0.07; 95% CI, 0.01–0.61; *P* = .016).[98] Another study of 95 patients found similar results.[97]

Management of Anal Carcinoma

Clinical Presentation/Evaluation

Approximately 45% of patients with anal carcinoma present with rectal bleeding, while approximately 30% have either pain or the sensation of a rectal mass.[15] Following confirmation of squamous cell carcinoma by biopsy, the recommendations of the NCCN Anal Carcinoma Guidelines Panel for the clinical evaluation of patients with anal canal or perianal cancer are very similar.

The panel recommends a thorough examination/evaluation, including a careful DRE, an anoscopic examination, and palpation of the inguinal lymph nodes, with FNA and/or excisional biopsy of nodes found to be enlarged by either clinical or radiologic examination. Evaluation of pelvic lymph nodes with CT or MRI of the pelvis is also recommended. These methods can also provide information on whether the tumor involves other abdominal/pelvic organs; however, assessment of T stage is primarily performed through clinical examination. A CT scan of the abdomen is also recommended to assess possible disease dissemination. Since veins of the anal region are part of the venous network associated with systemic circulation,[77] chest CT scan is performed to evaluate for pulmonary metastasis. Gynecologic exam, including cervical cancer screening, is suggested due to the association of anal cancer and HPV.[13] A discussion of infertility risks and counseling on fertility preservation, if appropriate, should be carried out prior to the start of treatment.

HIV testing should be performed if the patient's HIV status is unknown, because the risk of anal carcinoma has been reported to be higher in PLWH.[17] Furthermore, about 13% of people in the United States who are infected with HIV are not aware of their infection status,[101] and individuals who are unaware of their HIV-positive status do not receive the clinical care they need to reduce HIV-related morbidity and mortality and may unknowingly transmit HIV.[102] HIV testing may be particularly important in patients with cancer, because identification of HIV infection has the potential to improve clinical outcomes.[103] The CDC recommends HIV screening for all patients in all health care settings unless the patient declines testing (opt-out screening).[104]

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PET/CT scanning, or PET/MRI if available, can be considered to verify staging before treatment. PET/CT scanning has been reported to be useful in the evaluation of pelvic nodes, even in patients with anal canal cancer who have normal-sized lymph nodes on CT imaging.[105-110] A systematic review and meta-analysis of seven retrospective and five prospective studies calculated pooled estimates of sensitivity and specificity for detection of lymph node involvement by PET/CT to be 56% (95% CI, 45–67) and 90% (95% CI, 86–93), respectively.[106] A more recent meta-analysis of 17 clinical studies calculated the pooled sensitivity and specificity for detection of lymph node involvement by PET/CT at 93% and 76%, respectively.[111] The use of PET or PET/CT led to upstaging in 5% to 38% of patients and downstaging in 8% to 27% of patients. Another systematic review and meta-analysis found PET/CT to change nodal status and TNM stage in 21% and 41% of patients, respectively.[112] PET/CT results can also impact radiation therapy planning, as systematic reviews and meta-analyses have shown that treatment plan modifications occurred in 12% to 59% of patients based on PET/CT results.[111,113] The panel does not consider PET/CT to be a replacement for a diagnostic CT.

According to a systematic review and meta-regression, the proportion of patients who are node-positive by pretreatment clinical imaging has increased from 15.3% (95% CI, 10.5–20.1) in 1980 to 37.1% (95% CI, 34.0–41.3) in 2012 ($P < .0001$), likely resulting from the increased use of more sensitive imaging techniques.[114] This increase in lymph node positivity was associated with improvements in OS for both the lymph-node–positive and the lymph-node–negative groups. Because the proportion of patients with T3/T4 disease remained constant and therefore disease is not truly being diagnosed at more advanced stages over time, the authors attribute the improved OS results to the Will Rogers effect: The average survival of both groups increases as patients with worse-than-average survival in the node-negative group migrate to the node-positive group, in which their survival is better than average. Thus, the survival of individuals has not necessarily improved over time, even though the average survival of each group has. Using simulated scenarios, the authors further conclude that the actual rate of true node-positivity is likely less than 30%, suggesting that it is possible some patients are being misclassified and overtreated with the increased use of highly sensitive imaging.

Primary Treatment of Non-Metastatic Anal Carcinoma

In the past, patients with invasive anal carcinoma were routinely treated with an APR; however, local recurrence rates were high, 5-year survival was only 40% to 70%, and the morbidity with a permanent colostomy was considerable.[15] In 1974, Nigro and coworkers observed complete tumor regression in some patients with anal carcinoma treated with preoperative 5-FU–based concurrent chemotherapy and radiation (chemoRT) including either mitomycin or porfiromycin, suggesting that it might be possible to cure anal carcinoma without surgery and permanent colostomy.[115] Subsequent nonrandomized studies using similar regimens and varied doses of chemoRT provided support for this conclusion.[116,117] Results of randomized trials evaluating the efficacy and safety of administering chemotherapy with RT support the use of combined modality therapy in the treatment of anal cancer.[18] Summaries of clinical trials involving patients with anal cancer have been presented,[118,119] and several key trials are discussed below.

Chemotherapy

A phase III study from the EORTC compared the use of chemoRT (5-FU plus mitomycin) to RT alone in the treatment of anal carcinoma. Results from this trial showed that patients in the chemoRT arm had an 18% higher rate of locoregional control at 5 years and a 32% longer colostomy-free interval.[95] The United Kingdom Coordinating Committee on Cancer Research (UKCCCR) randomized ACT I trial confirmed that

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chemoRT with 5-FU and mitomycin was more effective in controlling local disease than RT alone (relative risk [RR], 0.54; 95% CI, 0.42–0.69; $P < .0001$), although no significant differences in OS were observed at 3 years.[120] A published follow-up study on these patients demonstrates that a clear benefit of chemoRT remains after 13 years, including a benefit in OS.[121] The median survival was 5.4 years in the RT arm and 7.6 years in the chemoRT arm. There was also a reduction in the risk of dying from anal cancer (HR, 0.67; 95% CI, 0.51–0.88; $P = .004$). A systematic review and meta-analysis comparing outcomes in patients with stage I anal carcinoma found an increased 5-year OS in patients treated with chemoRT compared to RT alone (RR, 1.18; 95% CI, 1.10–1.26; $P < .00001$) but no significant difference in 5-year DFS (RR, 1.01; 95% CI, 0.92–1.11; $P = 0.87$).[122] Conversely, a population-based cohort analysis of Medicare-eligible (>65 years of age or with an eligible disability) patients with stage I anal cancer showed no difference in OS, cause-specific survival, colostomy-free survival, or DFS with chemoRT versus RT alone after adjustment using propensity score methods.[123] Therefore, this study concludes that radiation alone may allow for adequate oncologic outcomes for highly selected patients with stage I anal cancer, although it is important to note that this study did not differentiate between anal canal and perianal cancers. Current NCCN Guideline *Recommendations for the Primary Treatment of Anal Canal Cancer* and *Recommendations for the Primary Treatment of Perianal Cancer* can be found below.

A few studies have addressed the efficacy and safety of specific chemotherapeutic agents in the chemoRT regimens used in the treatment of anal carcinoma.[93,124,125] In a phase III Intergroup study, patients receiving chemoRT with the combination of 5-FU and mitomycin had a lower colostomy rate (9% vs. 22%; $P = .002$) and a higher 4-year DFS (73% vs. 51%; $P = .0003$) compared with patients receiving chemoRT with 5-FU alone, indicating that mitomycin is an important component of chemoRT in the treatment of anal carcinoma.[125] The OS rate at 4 years was the same for the two groups, however, reflecting the ability to treat recurrent patients with additional chemoRT or an APR. The phase II JROSG 10-2 trial of 31 patients with squamous cell anal cancer treated with concurrent chemoRT with 5-FU and mitomycin in Japan has reported 2-year DFS, OS, local control, and colostomy-free survival of 77.4%, 93.5%, 83.9%, and 80.6%, respectively.[126]

Capecitabine, an oral fluoropyrimidine prodrug, is an accepted alternative to 5-FU in the treatment of colon and rectal cancer.[127-130] Capecitabine has been assessed as an alternative to 5-FU in chemoRT regimens for non-metastatic anal cancer.[131-134] Doses throughout the radiation course on treatment days may offer improved radiation sensitization compared to two courses of 5-FU infusion during the chemoRT course. A retrospective study compared 58 patients treated with capecitabine to 47 patients treated with infusional 5-FU; both groups also received mitomycin and concurrent radiation.[133] No significant differences were seen in clinical complete response, 3-year locoregional control, 3-year OS, or colostomy-free survival between the two groups of patients. Another retrospective study compared 27 patients treated with capecitabine to 62 patients treated with infusional 5-FU; as in the other study, both groups also received mitomycin and radiation.[132] Grade 3/4 hematologic toxicities were significantly lower in the capecitabine group, with no oncologic outcomes reported. A phase II study found that chemoRT with capecitabine and mitomycin was safe and resulted in a 6-month locoregional control rate of 86% (95% CI, 0.72–0.94) in patients with localized anal cancer.[135] Although data for this regimen are limited, the panel recommends mitomycin/capecitabine plus radiation as an alternative to mitomycin/5-FU plus radiation in the setting of stage I through III anal cancer.

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Cisplatin as a substitute for 5-FU was evaluated in a phase II trial, and results suggest that cisplatin-containing and 5-FU–containing chemoRT may be comparable for treatment of locally advanced anal cancer.[124]

The efficacy of replacing mitomycin with cisplatin has also been assessed. The phase III UK ACT II trial compared cisplatin with mitomycin and also looked at the effect of additional maintenance chemotherapy following chemoRT.[136] In this study, more than 900 patients with newly diagnosed anal cancer were randomly assigned to primary treatment with either 5-FU/mitomycin or 5-FU/cisplatin with radiotherapy. A continuous course (ie, no treatment gap) of radiation of 50.4 Gy was administered in both arms, and patients in each arm were further randomized to receive two cycles of maintenance therapy with 5-FU and cisplatin or no maintenance therapy. At a median follow-up of 5.1 years, no differences were observed in the primary endpoint of complete response rate in either arm for the chemoRT comparison or in the primary endpoint of progression-free survival (PFS) for the comparison of maintenance therapy versus no maintenance therapy. In addition, a secondary endpoint, colostomy, did not show differences based on the chemotherapeutic components of chemoRT. These results demonstrate that replacement of mitomycin with cisplatin in chemoRT does not affect the rate of complete response, nor does administration of maintenance therapy decrease the rate of disease recurrence following primary treatment with chemoRT in patients with anal cancer.

Cisplatin as a substitute for mitomycin in the treatment of patients with non-metastatic anal carcinoma was also evaluated in the randomized phase III Intergroup RTOG 98-11 trial. The role of induction chemotherapy was also assessed. In this study, 682 patients were randomly assigned to receive either: 1) induction 5-FU plus cisplatin for two cycles followed by concurrent chemoRT with 5-FU and cisplatin; or 2) concurrent chemoRT with 5-FU and mitomycin.[93,137] A significant difference was observed in the primary endpoint, 5-year DFS, in favor of the mitomycin group (57.8% vs. 67.8%; $P = .006$).[137] Five-year OS was also significantly better in the mitomycin arm (70.7% vs. 78.3%; $P = .026$).[137] In addition, 5-year colostomy-free survival showed a trend towards statistical significance (65.0% vs. 71.9%; $P = .05$), again in favor of the mitomycin group. Since the two treatment arms in the RTOG 98-11 trial differed with respect to use of either cisplatin or mitomycin in concurrent chemoRT as well as inclusion of induction chemotherapy in the cisplatin-containing arm, it is difficult to attribute the differences to the substitution of cisplatin for mitomycin or to the use of induction chemotherapy.[118,138] However, since ACT II demonstrated that the two chemoRT regimens are equivalent, some have suggested that results from RTOG 98-11 suggest that induction chemotherapy is probably detrimental.[139]

Results from ACCORD 03 also suggest that there is no benefit of a course of chemotherapy given prior to chemoRT.[140] In this study, patients with locally advanced anal cancer were randomized to receive induction therapy with 5-FU/cisplatin or no induction therapy followed by chemoRT (they were further randomized to receive an additional radiation boost or not). No differences were seen between tumor complete response, tumor partial response, 3-year colostomy-free survival, local control, event-free survival, or 3-year OS. After a median follow-up of 50 months, no advantage to induction chemotherapy (or to the additional radiation boost) was observed, consistent with earlier results. A systematic review of randomized trials also showed no benefit to a course of induction chemotherapy.[141]

A retrospective analysis, however, suggests that induction chemotherapy preceding chemoRT may be beneficial for the subset of patients with T4 anal cancer.[142] The 5-year colostomy-free survival rate

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was significantly better in T4 patients who received induction 5-FU/cisplatin compared to those who did not (100% vs. 38 ± 16.4%; *P* = .0006).

The combination of 5-FU, mitomycin C, and cisplatin has also been studied in a phase II trial, but was found to be too toxic.[143] The safety and efficacy of capecitabine/oxaliplatin with radiation for the treatment of localized anal cancer has been investigated in a phase II study, which reported that the regimen was safe, with promising efficacy, although larger trials would be needed to confirm these results.[144]

There has also been interest in the use of biologic therapies for the treatment of anal cancer. A phase 3 trial is investigating the use of the programmed cell death protein 1 (PD-1) inhibitor, nivolumab, following combined modality therapy for high risk anal carcinoma.[145] This trial has completed enrollment of 344 participants and results are pending. Cetuximab is an epidermal growth factor receptor (EGFR) inhibitor, whose anti-tumor activity is dependent on the presence of wild-type *KRAS*.[146] Because *KRAS* mutations appear to be very rare in anal cancer,[147,148] the use of an EGFR inhibitor such as cetuximab has been considered to be a promising avenue of investigation. The phase II ECOG 3205 and AIDS Malignancy Consortium 045 trials evaluated the safety and efficacy of cetuximab with cisplatin/5-FU and radiation in immunocompetent (E3205) and PLWH (AMC045) with anal squamous cell carcinoma.[149,150] Results from E3205 and AMC045 were published in 2017. In a post hoc analysis of E3205, the 3-year locoregional failure rate was 21% (95% CI, 7–26) by Kaplan-Meier estimate.[149] The toxicities associated with the regimen were substantial, with grade 4 toxicity occurring in 32% of the study population and three treatment-associated deaths (5%). In AMC045, the 3-year locoregional failure rate was 20% (95% CI, 10–37) by Kaplan-Meier estimate.[150] Grade 4 toxicity and treatment-associated rates were similar to that seen in E3205, at 26% and 4%, respectively. Two other trials that have assessed the use of cetuximab in this setting have also found it to increase toxicity, including a phase I study of cetuximab with 5-fluorouracil, cisplatin, and radiation.[151] The ACCORD 16 phase II trial, which was designed to assess response rate after chemoRT with cisplatin/5-FU and cetuximab, was terminated prematurely because of extremely high rates of serious adverse events.[152] The 15 evaluable patients from ACCORD 16 had a 4-year DFS rate of 53% (95% CI, 28–79), and two of the five patients who completed the planned treatments had locoregional recurrences.[153]

For older patients or those who are unlikely to tolerate mitomycin, the optimal chemotherapy regimen remains uncertain. Some NCCN Panel members have used a combination of weekly cisplatin and daily 5-FU on days of radiation[154] for chemoRT in localized anal cancer. Other potential strategies for this patient population may include capecitabine plus RT or RT alone (without chemotherapy). However, due to a lack of data supporting this approach and differing strategies among panel members, there are not yet defined recommendations for patients with anal cancer who are not candidates for intensive therapy. Use of a geriatric assessment to guide management and elicitation of the patient's goals and objectives with regard to their cancer diagnosis is critical to inform shared decision-making discussions in these situations (See the NCCN Guidelines for Older Adult Oncology).

Radiation Therapy

Prior to the start of RT, patients should be counseled on infertility risks and given information regarding sperm banking or oocyte, egg, or ovarian tissue banking, as appropriate. In addition, patients should be counseled on risks for early treatment-induced menopause and changes to sexual function. See the NCCN Guidelines for Survivorship and the NCCN Guidelines for Adolescent and Young Adult (AYA) Oncology for more information. Patients should be considered for

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vaginal dilators daily during treatment, which can reduce RT doses to sexual organs at risk,[155] and instructed on the symptoms of vaginal stenosis.

The optimal dose and schedule of RT for anal carcinoma continues to be explored and has been evaluated in a number of nonrandomized studies. In one study of patients with early-stage (T1 or Tis) anal canal cancer, most patients were effectively treated with RT doses of 40 to 50 Gy for Tis lesions and 50 to 60 Gy for T1 lesions.[156] In another study, in which the majority of patients had stage II/III anal canal cancer, local control of disease was higher in patients who received RT doses greater than 50 Gy than in those who received lower doses (86.5% vs. 34%; $P = .012$).[157] In a third study of patients with T3, T4, or lymph node-positive tumors, RT doses of greater than or equal to 54 Gy administered with limited treatment breaks (<60 days) were associated with increased local control.[158] The effect of further escalation of radiation dose was assessed in the ACCORD 03 trial, with the primary endpoint of colostomy-free survival at 3 years.[140] No benefit was seen with the higher dose of radiation. These results are supported by much earlier results from the RTOG 92-08 trial[159] and suggest that doses of greater than 59 Gy provide no additional benefit to patients with anal cancer. The randomized, phase 2 DECREASE study (NCT04166318) is currently looking at how well lower-dose chemoRT works in comparison to standard-dose chemoRT for patients with stage I or IIA anal cancer.[160] Patients on this study are randomized to either 28 fractions (standard-dose) or 20 or 23 fractions (deintensified dose) of intensity-modulated radiation therapy (IMRT). Study completion is expected in 2025.

There is evidence that treatment interruptions, either planned or required by treatment-related toxicity, can compromise the effectiveness of treatment.[109] In the phase II RTOG 92-08 trial, a planned 2-week treatment break in the delivery of chemoRT to patients with anal cancer was associated with increased locoregional failure rates and lower colostomy-free survival rates when compared to patients who only had treatment breaks for severe skin toxicity,[161] although the trial was not designed for that particular comparison. In addition, the absence of a planned treatment break in the ACT II trial was considered to be at least partially responsible for the high colostomy-free survival rates observed in that study (74% at 3 years).[136] A post hoc analysis from the ACT II trial revealed worse outcomes if the planned RT dose was extended to more than 42 days, with a significant increase in the risk of PFS event ($P = .01$) and worse OS ($P = .006$).[162] Although results of these and other studies have supported the benefit of delivery of chemoRT over shorter time periods,[163-165] treatment breaks in the delivery of chemoRT are required in up to 80% of patients since chemoRT-related toxicities are common.[165] For example, it has been reported that one-third of patients receiving primary chemoRT for anal carcinoma at RT doses of 30 Gy in 3 weeks develop acute anoproctitis and perineal dermatitis, increasing to one-half to two-thirds of patients when RT doses of 54 to 60 Gy are administered in 6 to 7 weeks.[77]

Some of the reported late side effects of chemoRT include increased frequency and urgency of defecation, chronic perineal dermatitis, dyspareunia, and impotence.[166,167] In some cases, severe late RT complications, such as anal ulcers, stenosis, and necrosis, may necessitate surgery involving colostomy.[167] In addition, results from a retrospective cohort study of data from the SEER registry showed the risk of subsequent pelvic fracture to be 3-fold higher in female patients ≥65 years undergoing RT for anal cancer compared with female patients of the same age with anal cancer who did not receive RT.[168]

An increasing body of literature suggests that toxicity can be reduced with advanced radiation delivery techniques.[109,169-179] IMRT utilizes

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detailed beam shaping to target specific volumes and limit the exposure of normal tissue.[178] Multiple pilot studies have demonstrated reduced toxicity while maintaining local control using IMRT. For example, in a cross-study comparison of a multicenter study of 53 patients with anal cancer treated with concurrent 5-FU/mitomycin chemotherapy and IMRT compared to patients in the 5-FU/mitomycin arm of the randomized RTOG 98-11 study, which used conventional 3-D RT, the rates of grade 3/4 dermatologic toxicity were 38%/0% for patients treated with IMRT compared to 43%/5% for those undergoing conventional RT.[93,178] No decrease in treatment effectiveness or local control rates was observed with use of IMRT, although the small sample size and short duration of follow-up limit the conclusions drawn from such a comparison. In one retrospective comparison between IMRT and conventional radiotherapy, IMRT was less toxic and showed better efficacy in 3-year OS, locoregional control, and PFS.[180] In a larger retrospective comparison, no significant differences in local recurrence-free survival, distant metastasis-free survival, colostomy-free survival, and OS at 2 years were seen between patients receiving IMRT and those receiving 3-D conformal radiotherapy, despite the fact that the IMRT group had a higher average N stage.[181]

RTOG 0529 was a prospective clinical trial investigating if dose-painted IMRT/5-FU/mitomycin could decrease the rate of gastrointestinal and genitourinary adverse effects compared to patients treated with conventional radiation/5-FU/mitomycin from RTOG 98-11. This trial did not meet its primary endpoint of reducing grade 2+ combined acute genitourinary and gastrointestinal adverse events by 15% compared to conventional radiation on RTOG 98-11.[182] Of 52 evaluable patients, the grade 2+ combined acute adverse event rate was 77%; the rate in RTOG 98-11 was also 77%. However, significant reductions were seen in grade 2+ hematologic events (73% vs. 85%; $P = .032$), grade 3+ gastrointestinal events (21% vs. 36%; $P = .008$), and grade 3+ dermatologic events (23% vs. 49%; $P < .0001$). Subsequently, long-term outcomes and toxicities of patients with anal cancer treated with dose-painted IMRT as per RTOG 0529 have been reported.[183,184] Of 99 eligible patients identified in the 2017 publication, 92% had a clinically complete response after a median follow-up of 49 months.[184] The 4-year OS was 85.5% and the 4-year event-free survival was 75.5%. The rate of grade greater than or equal to two non-hematologic late toxicities was 15%. In a longer-term follow-up with 52 eligible patients, the 8-year OS was 68% and the 8-year disease-free survival was 62%.[183] The rate of grade 2 late adverse events was 55%, 16% for grade 3, 0 for grade 4, and 4% for grade 5 events.

A retrospective cohort study using the 2014 linkage of the SEER-Medicare database showed that IMRT is associated with higher total costs than 3-D conformal radiation (median total cost, $35,890 vs. $27,262; $P < .001$), but unplanned health care utilization costs (ie, hospitalizations and emergency department visits) are higher for those receiving conformal radiation (median, $711 vs. $4,957 at 1 year; $P = .02$).[185]

Recommendations regarding RT doses follow the multifield technique used in the RTOG 98-11 trial.[93] After clinical and radiologic staging, CT-based simulation is performed for radiation treatment planning. If available, MRI pelvis, PET/CT, or PET/ MRI (if available) at the time of simulation may be helpful to define local and regional target structures. All patients should receive a minimum RT dose of 45 Gy to the primary cancer. The recommended initial RT dose is 30.6 Gy to the pelvis, anus, perineum, and inguinal nodes; there should be attempts to reduce the dose to the femoral heads. Field reduction off the superior field border and node-negative inguinal nodes is recommended after delivery of 30.6 Gy and 36 Gy, respectively. For patients treated with an anteroposterior-posteroanterior (AP-PA) rather than multifield

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technique, the dose to the lateral inguinal region should be brought to the minimum dose of 36 Gy using an anterior electron boost matched to the PA exit field. Patients with disease clinically staged as node-positive or T2–T4 should receive an additional boost of 9 to 14 Gy. The consensus of the panel is that IMRT is preferred over 3-D conformal RT in the treatment of anal carcinoma.[186] IMRT requires expertise and careful target design to avoid reduction in local control by marginal miss.[109] The clinical target volumes for anal cancer used in the RTOG 0529 trial have been described in detail.[186] Also see https://www.nrgoncology.org/Portals/0/Scientific%20Program/CIRO/Atlases/AnorectalContouringGuidelines.pdf for more details of the contouring atlas defined by RTOG.

For patients with previously untreated anal cancer who present with synchronous local and metastatic disease, chemoRT to the primary site can be considered for local control following first-line chemotherapy, as described in these guidelines. For recurrence in the primary site or nodes after previous chemoRT, surgery should be performed if possible, and, if not, palliative chemoRT can be considered based on symptoms, extent of recurrence, and prior treatment.

Surgical Management

Local excision is used for anal cancer in two situations. The first is for superficially invasive squamous cell carcinoma (SISCCA), which is defined as anal cancer that has been completely excised, with less than or equal to 3-mm basement membrane invasion and a maximal horizontal spread of less than or equal to 7 mm (T1,NX).[187] SISCCA are generally found incidentally in the setting of a biopsy or excision of what is thought to be a benign lesion such as a condyloma, hemorrhoid, or anal skin tag. Such lesions are being seen with increasing frequency because anal cancer screening in high-risk populations is becoming more common. For SISCCA that are noted to have histologically negative margins in carefully selected patients followed by an experienced provider and/or team, local excision alone with a structured surveillance plan may represent adequate treatment. A careful surveillance plan is necessary as observational studies have reported detection of HSIL in 74% of patients following local excision.[188] A retrospective study described characteristics, treatment, and outcomes of 17 patients with completely excised invasive anal cancer, seven of whom met the criteria for classification as superficially invasive.[189] Those with positive margins (≤2 mm for anal canal cancer and <1 cm for perianal cancer) received local radiation, and all patients underwent surveillance. After a median follow-up of 45 months, no differences were seen in 5-year OS (100% for the entire cohort) or 5-year cancer recurrence-free survival rates (87% for the entire cohort) between the superficially invasive and invasive groups.

Local excision is also used for T1,N0, well-differentiated or select T2,N0 perianal (anal margin) cancer that does not involve the sphincter (also see *Recommendations for the Primary Treatment of Perianal Cancer*, below). In these cases, a 1-cm margin is recommended. A retrospective cohort study that included 2243 adults from the National Cancer Database diagnosed with T1,N0 anal canal cancer between 2004 and 2012 found that the use of local excision in this population increased over time (17.3% in 2004 to 30.8% in 2012; $P < .001$).[190] No significant difference in 5-year OS was seen based on management strategy (85.3% for local excision; 86.8% for chemoRT; $P = .93$). Many patients with T1 or selected T2 perianal cancers will have concomitant HSIL of the anal canal, therefore it is important to look for such anal canal involvement when conservative management (local excision) is being considered.

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Radical surgery in anal cancer (APR) is reserved for local recurrence or disease persistence (see *Treatment of Locally Progressive or Recurrent Anal Carcinoma*, below).

Treatment of Anal Cancer in Patients Living with HIV/AIDS

As discussed above (see *Risk Factors*), PLWH have been reported to be at increased risk for anal carcinoma.[18,28-31] Some evidence suggests that ART may be associated with a decrease in the incidence of high-grade AIN and its progression to anal cancer.[35,191] However, the incidence of anal cancer in PLWH has not decreased much, if at all, over time.[27,29,31,34]

Most evidence regarding outcomes in PLWH with anal cancer comes from retrospective comparisons, a few of which found worse outcomes in PLWH.[192-194] For example, a cohort comparison of 40 PLWH with anal canal cancer and 81 patients who were HIV-negative with anal canal cancer found local relapse rates to be four times higher in PLWH at 3 years (62% vs. 13%) and found significantly higher rates of severe acute skin toxicity for PLWH.[193] However, no differences in rates of complete response or 5-year OS were observed between the groups in that study. Another systematic review and meta-analysis of 40 studies including 3720 patients with localized squamous cell carcinoma of the anus who were treated with chemoRT, 34% of whom were HIV-positive, found a greater risk of grade 3 and higher cutaneous toxicities (RR = 1.34), and worse 3-year DFS (RR = 1.32) and OS (RR = 1.77) rates, in PLWH compared to those who were HIV-negative.[194]

Most studies, however, have found outcomes to be similar in PLWH and patients who were HIV-negative.[195-202] In a retrospective cohort study of 1184 veterans diagnosed with squamous cell carcinoma of the anus between 1998 and 2004 (15% of whom tested positive for HIV), no differences with respect to receipt of treatment or 2-year survival rates were observed when the group of PLWH was compared with the group of patients testing negative for HIV.[197] Another study of 36 consecutive patients with anal cancer including 19 immunocompetent and 17 patients who were immunodeficient (14 PLWH) showed no difference in the efficacy or toxicity of chemoRT.[201] A population-based study of almost 2 million patients with cancer, including 6459 PLWH, found no increase in cancer-specific mortality for anal cancer in PLWH.[203] Although the numbers of PLWH in these studies have been small, the efficacy and safety results appear similar regardless of HIV status.

Overall, the panel believes that PLWH who have anal cancer should be treated as per these guidelines and that modifications to treatment of anal cancer should not be made solely based on HIV status. Additional considerations for PLWH who have anal cancer are outlined in the NCCN Guidelines for Cancer in People Living with HIV, including the use of normal tissue-sparing radiation techniques, the consideration of non-malignant causes for lymphadenopathy, and the need for more frequent post-treatment surveillance anoscopy for PLWH. Poor performance status in PLWH and anal cancer may be from HIV, cancer, or other causes. The reason for poor performance status should be considered when making treatment decisions. Treatment with ART may improve poor performance status related to HIV.

Recommendations for the Primary Treatment of Anal Canal Cancer

Currently, concurrent chemoRT is the recommended primary treatment for patients with non-metastatic anal canal cancer as well as for patients with positive para-aortic lymph nodes that can be included in the radiation field, although only limited retrospective data support use in this setting.[204] Mitomycin/5-FU or mitomycin/capecitabine is administered concurrently with radiation.[93,132-134] Alternatively, 5-FU/cisplatin can be given with concurrent radiation (category 2B).[205] Most studies have delivered 5-FU as a protracted 96- to 120-hour infusion during the first and fifth weeks of RT, and bolus injection of

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mitomycin is typically given on the first or second day of the 5-FU infusion.[77] Capecitabine is given orally, Monday through Friday, on each day that RT is given, for 4 or 6 weeks, with bolus injection of mitomycin and concurrent radiation.[132,134]

An analysis of the National Cancer Database found that only 61.5% of patients with stage I anal canal cancer received chemoRT as recommended in these guidelines.[206] Patients who were male, aged ≥70 years, had smaller or lower-grade tumors, or who had been evaluated at academic facilities were more likely than others to be treated with excision alone. In a separate analysis of the National Cancer Database, 88% of patients with stage II/III anal canal cancer received chemoRT.[207] Males, Black patients, those with multiple comorbidities, and those treated in academic facilities were less likely to receive combined modality treatment.

RT is associated with significant side effects. Patients should be counseled on infertility risks and given information regarding sperm, oocyte, egg, or ovarian tissue banking prior to treatment. In addition, patients should be considered for vaginal dilators and should be instructed on the symptoms of vaginal stenosis.

Recommendations for the Primary Treatment of Perianal Cancer

Perianal lesions can be treated with either local excision or chemoRT depending on the clinical stage. Primary treatment for patients with T1,N0 well-differentiated or select smaller T2,N0 perianal (anal margin) cancer that does not involve the sphincter is by local excision with adequate margins. The ASCRS defines an adequate margin as 1 cm.[46] If the margins are not adequate, re-excision is the preferred treatment option. Local RT with or without continuous infusion 5-FU/mitomycin, mitomycin/capecitabine, or 5-FU/cisplatin (category 2B) can be considered as alternative treatment options when surgical margins are inadequate. For all other perianal cancers, the treatment options are the same as for anal canal cancer (see above).[93,132-134,205]

Surveillance Following Primary Treatment

Following primary treatment of non-metastatic anal cancer, the surveillance and follow-up treatment recommendations for perianal and anal canal cancer are the same. Patients are re-evaluated by DRE between 8 and 12 weeks after completion of chemoRT. Following re-evaluation, patients are classified according to whether they have a complete remission of disease, persistent disease, or progressive disease. Patients with persistent disease but without evidence of progression may be managed with close follow-up (in 4 weeks) to see if further regression occurs.

The National Cancer Research Institute's ACT II study compared different chemoRT regimens and found no difference in OS or PFS.[136] Interestingly, 72% of patients in this trial who did not show a complete response at 11 weeks from the start of treatment had achieved a complete response by 26 weeks. 5-year survival was superior in patients who achieved complete response at 26 weeks.[208] Based on these results, the panel believes it may be appropriate to follow patients who have not achieved a complete clinical response with persistent anal cancer for up to 6 months after completion of radiation and chemotherapy, as long as there is no evidence of progressive disease during this period of follow-up. Persistent disease may continue to regress for up to 6 months from the start of treatment, and APR can thereby be avoided in some patients. In these patients, observation and re-evaluation should be performed at 3-month intervals. The panel recommends against the use of PET/CT imaging as part of this re-evaluation strategy due to concerns for false-positivity from local inflammation from RT leading to unnecessary surgeries. If biopsy-proven disease progression occurs, further intensive treatment is

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indicated (see *Treatment of Locally Progressive or Recurrent Anal Carcinoma*, below).

Although a clinical assessment of progressive disease requires histologic confirmation, patients can be classified as having a complete remission without biopsy verification if clinical evidence of disease is absent. The panel recommends that these patients undergo evaluation every 3 to 6 months for 5 years, including DRE and inguinal node palpation. Anoscopic evaluation is recommended every 6 to 12 months for 3 years. Annual chest, abdominal, and pelvic CT with contrast or chest CT without contrast and abdominal/pelvic MRI with contrast is recommended for 3 years for patients who initially had stage II–III disease.

Treatment of Locally Progressive or Recurrent Anal Carcinoma

Despite the effectiveness of chemoRT in the primary treatment of anal carcinoma, rates of locoregional failure of 10% to 30% have been reported.[209,210] Some of the disease characteristics that have been associated with higher recurrence rates following chemoRT include higher T stage and higher N stage (also see the section on *Prognostic Factors*, above).[211]

Evidence of progression found on DRE should be followed by biopsy as well as restaging with CT and/or PET/CT imaging. Patients with biopsy-proven locally progressive disease are candidates for radical surgery with an APR and colostomy.[210] In an attempt to avoid surgery, the use of immunotherapy with nivolumab or pembrolizumab may be considered prior to APR (category 2B) as some patients may have a good response, however it should be noted that this approach is based on institutional experience only and there are currently no published data supporting its use in this setting of otherwise curative intent surgery.

A multicenter retrospective cohort study looked at the cause-specific colostomy rates in 235 patients with anal cancer who were treated with radiotherapy or chemoRT from 1995 to 2003.[212] The 5-year cumulative incidence rates for tumor-specific and therapy-specific colostomy were 26% (95% CI, 21–32) and 8% (95% CI, 5–12), respectively. Larger tumor size (>6 cm) was a risk factor for tumor-specific colostomy, while local excision prior to radiotherapy was a risk factor for therapy-specific colostomy. However, it should be noted that these patients were treated with older chemotherapy and RT regimens, which could account for these high colostomy rates.[213]

In studies involving a minimum of 25 patients undergoing an APR for anal carcinoma, 5-year survival rates of 39% to 66% have been observed.[209,210,214-218] Complication rates were reported to be high in some of these studies. Factors associated with worse prognosis following APR include an initial presentation of node-positive disease and RT doses less than 55 Gy used in the treatment of primary disease.[210]

The general principles for APR technique are similar to those for distal rectal cancer and include the incorporation of meticulous total mesorectal excision (TME). However, APR for anal cancer may require wider lateral perianal margins than are required for rectal cancer. A retrospective analysis of the medical records of 14 patients who received intraoperative radiation therapy (IORT) during APR revealed that IORT is unlikely to improve local control or to give a survival benefit.[219]

Because of the necessary exposure of the perineum to radiation, patients with anal cancer are prone to poor perineal wound healing. It has been shown that for patients undergoing an APR that was preceded by RT, closure of the perineal wound using rectus abdominis myocutaneous flap reconstruction results in decreased perineal wound

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complications.[220,221] Reconstructive tissue flaps for the perineum, such as the vertical rectus or local myocutaneous flaps, should therefore be considered for patients with anal cancer undergoing an APR.

Inguinal node dissection is recommended for recurrence in that area and for patients who require an APR but have already received groin radiation. Inguinal node dissection can be performed with or without an APR depending on whether disease is isolated to the groin or has occurred in conjunction with recurrence or persistence at the primary site.

Patients who develop inguinal node metastasis who do not undergo an APR can be considered for palliative RT to the groin with or without 5-FU/mitomycin or mitomycin/capecitabine if no prior RT to the groin was given. Radiation therapy technique and doses are dependent on dosing and technique of prior treatment (see the guidelines above). If RT was given previously, 5-FU/cisplatin chemotherapy may be given (category 2B).

Surveillance Following Treatment of Recurrence

Following APR, patients should undergo re-evaluation every 3 to 6 months for 5 years, including clinical evaluation for nodal metastasis (ie, inguinal node palpation). In addition, it is recommended that these patients undergo annual chest, abdominal, and pelvic CT with contrast or chest CT without contrast and abdominal/pelvic MRI with contrast for 3 years. In one retrospective study of 105 patients with anal canal carcinoma who had an APR between 1996 and 2009, the overall recurrence rate following APR was 43%.[222] Those with T3/4 tumors or involved margins were more likely to experience recurrence. The 5-year survival rate after APR has been reported to be 60% to 64%.[222,223]

Following treatment of inguinal node recurrence, patients should have a DRE and inguinal node palpation every 3 to 6 months for 5 years. In addition, anoscopy every 6 to 12 months and annual chest, abdominal, and pelvic CT with contrast or chest CT without contrast and abdominal/pelvic MRI with contrast are recommended for 3 years.

Treatment of Metastatic Anal Cancer

It has been reported that the most common sites of anal cancer metastasis outside of the pelvis are the liver, lung, and extrapelvic lymph nodes.[224] Since anal carcinoma is a rare cancer and only 10% to 20% of patients with anal carcinoma present with extrapelvic metastatic disease,[224] only limited data are available on this population of patients. Despite this fact, evidence indicates that systemic therapy has some benefit in patients with metastatic anal carcinoma.

Palliative chemoRT to the primary site can be administered following upfront chemotherapy for local control of a symptomatic bulky primary. In fact, an analysis of the National Cancer Database reported that patients with newly diagnosed metastatic anal cancer who received definitive pelvic RT in addition to chemotherapy had longer median OS than those who received chemotherapy alone (21.3 vs. 15.9 months; HR, 0.70; 95% CI, 0.61–0.81; $P < .001$).[225] A retrospective analysis of 106 patients with squamous cell carcinoma reported that resection or ablation of liver metastases can result in long-term survival and that patients with anal cancer had better outcomes than those with non-anal squamous cell carcinoma, although this approach is not currently included in the NCCN Guidelines for Anal Carcinoma.[226]

First-Line Treatment of Metastatic Anal Cancer

Based on results from the phase II International Multicentre InterAACT study, carboplatin in combination with paclitaxel has been noted as the preferred regimen for first-line treatment of metastatic anal cancer by the NCCN Panel.[227] In this trial, 91 patients with previously untreated, unresectable, locally recurrent or metastatic anal squamous cell

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carcinoma were randomized to either carboplatin plus paclitaxel or cisplatin plus 5-FU. While response rates were similar between carboplatin plus paclitaxel and cisplatin plus 5-FU (59% and 57%, respectively), carboplatin plus paclitaxel showed lower toxicity compared to cisplatin plus 5-FU (71% vs. 76% grade ≥3 toxicity and 36% vs. 62% [*P* = .016] serious adverse events). Median PFS and OS were 8.1 months and 20 months for carboplatin plus paclitaxel and 5.7 months and 12.3 months for cisplatin plus 5-FU (HR for OS, 2.0; 95% CI, 1.15–3.47; *P* = .014).[227] The results from the InterAACT trial are in agreement with older studies that showed that chemotherapy with a fluoropyrimidine-based regimen plus cisplatin[205,228-230] or a platinum-based therapy plus paclitaxel[229,231,232] benefited some patients with metastatic anal carcinoma.

Other recommended treatment options include 5-FU, leucovorin, and cisplatin (FOLFCIS); 5-FU, leucovorin, and oxaliplatin (FOLFOX); 5-FU plus cisplatin (category 2B reflecting its similar efficacy, but higher toxicity, when compared to carboplatin plus paclitaxel in a randomized trial); or modified docetaxel, cisplatin, and 5-FU (DCF, category 2B). A retrospective study of 53 patients with advanced anal squamous cell carcinoma who received FOLFCIS as first-line therapy showed that this regimen was safe and effective in this patient population. The response rate was 48%, PFS was 7.1 months, and OS was 22.1 months.[233] The safety of FOLFOX in patients with anal cancer has been demonstrated in a case report.[234] Despite the limited data for FOLFOX in this setting, the panel added it based on consensus and its current use as a standard option at many NCCN Member Institutions. With use of FOLFOX, the panel recommends strong consideration of discontinuation of oxaliplatin after 3 to 4 months (or sooner for unacceptable neurotoxicity) while maintaining other agents until time of disease progression.[235] Oxaliplatin may be reintroduced if it was discontinued for neurotoxicity rather than for disease progression.

DCF is another regimen that has been evaluated for metastatic anal cancer.[236,237] A single-arm phase II trial evaluated this regimen in patients with previously untreated, advanced anal squamous cell carcinoma. This trial demonstrated the efficacy of DCF (both standard and modified regimens) in this setting and reported better tolerability of modified DCF compared to the standard regimen.[236] The median PFS was 10.7 months for the standard DCF regimen and 11.0 months for the modified regimen. For the standard regimen, 83% of patients had at least one grade 3–4 AE, while 53% had at least one grade 3–4 adverse event when treated with modified DCF. The most common grade 3–4 adverse events were neutropenia, diarrhea, asthenia, anemia, lymphopenia, mucositis, and vomiting. Based on these results, the panel added modified DCF as an option for metastatic anal cancer, with the category 2B designation reflecting concerns voiced by some panel members about potentially higher toxicity with modified DCF compared to the other regimens recommended for metastatic anal cancer.

Several ongoing clinical trials are investigating whether checkpoint inhibitors could have a role in the first-line treatment of metastatic anal cancer. NCT04444921 is a randomized, phase 3 trial comparing chemotherapy alone (carboplatin and paclitaxel) to chemotherapy plus nivolumab for treatment-naïve metastatic anal cancer.[238] This study is expected to enroll 205 participants and complete in 2023. POD1UM-303/InterAACT2 is a similar, phase 3 global study (NCT04472429) investigating the addition of the checkpoint inhibitor, retifanlimab, to carboplatin/paclitaxel chemotherapy and comparing it to chemotherapy alone.[239] This trial expects to enroll 300 participants with previously untreated metastatic anal carcinoma and expected completion is in 2024.

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Second-Line Treatment of Metastatic Anal Cancer

A single-arm, multicenter phase 2 trial assessed the safety and efficacy of the anti-PD-1 antibody nivolumab for refractory metastatic anal cancer.[240] Two complete responses and seven partial responses were seen among the 37 enrolled participants who received at least one dose, for a response rate of 24% (95% CI, 15–33). The KEYNOTE-028 trial is a multi-cohort, phase 1b trial of the anti-PD-1 antibody pembrolizumab in 24 patients with programmed cell death ligand 1 (PD-L1)–positive advanced squamous cell carcinoma of the anal canal.[241] Four partial responses were seen, for a response rate of 17% (95% CI, 5–37), and 10 patients (42%) had stable disease, for a disease control rate of 58%. In both trials, toxicities were manageable, with 13% and 17% experiencing grade 3 adverse events with nivolumab and pembrolizumab, respectively.[240,241] The phase II KEYNOTE-158 study investigated the use of pembrolizumab in patients with noncolorectal microsatellite instability-high (MSI-H)/ deficient mismatch repair (dMMR) cancers, including patients with anal cancer (cohort A).[242,243] A total of 112 patients with anal cancer were enrolled and treated, 67% of whom had PD-L1-positive disease[243]. A total of 11% of patients (95% CI, 6–18) had an objective response, with responses in 15% (95% CI, 8–25) of patients with PD-L1-positive disease and in 3% (95% CI, 0–17) with PD-L1-negative disease. Serious treatment-related adverse events were noted in 11% of patients, with 25% of patients having immune-mediated events. This study demonstrated the clinical benefit of pembrolizumab for patients with previously treated advanced anal squamous cell carcinoma.

A phase 2 clinical trial (NCT02314169) is also underway investigating the efficacy and safety of nivolumab, with or without ipilimumab, for patients with refractory metastatic anal canal cancer.[244] This trial has an estimated enrollment of 137 participants and is expected to complete in February 2024. Other trials are investigating novel second-line agents for metastatic anal cancer, including the phase 2 PODIUM-202 trial of retifanlimab for advanced or metastatic squamous cell carcinoma of the anal canal that progressed following platinum-based chemotherapy.[245]

Although further studies of PD-1/PD-L1 inhibitors are warranted, the panel added nivolumab and pembrolizumab as preferred options for patients with metastatic anal cancer who have progressed on first-line chemotherapy in the 2018 version of these guidelines. Microsatellite instability (MSI)/mismatch repair (MMR) testing is not required. MSI is uncommon in anal cancer,[246] and as discussed above, responses to PD-1/PD-L1 inhibitors occur in 20% to 24% of patients.[240,241] Anal cancers may be responsive to PD-1/PD-L1 inhibitors because they often have high PD-L1 expression and/or a high tumor mutational load despite being microsatellite stable (MSS).[246]

The panel also notes that platinum-based chemotherapy should not be given in second line if disease progressed on platinum-based therapy in first line.

Survivorship

The panel recommends that a prescription for survivorship and transfer of care to the primary care physician be written.[247] The oncologist and primary care provider should have defined roles in the surveillance period, with roles communicated to the patient. The care plan should include an overall summary of treatments received, including surgeries, radiation treatments, and chemotherapy. The possible expected time to resolution of acute toxicities, long-term effects of treatment, and possible late sequelae of treatment should be described. Finally, surveillance and health behavior recommendations should be part of the care plan.

Disease-preventive measures, such as immunizations; early disease detection through periodic screening for second primary cancers (eg,

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breast, cervical, prostate cancers); and routine good medical care and monitoring are recommended (see the NCCN Guidelines for Survivorship). Additional health monitoring should be performed as indicated under the care of a primary care physician. Survivors are encouraged to maintain a therapeutic relationship with a primary care physician throughout their lifetime.[248]

Other recommendations include monitoring for late sequelae of anal cancer or the treatment of anal cancer. Late toxicity from pelvic radiation can include bowel dysfunction (ie, increased stool frequency, fecal incontinence, flatulence, rectal urgency), urinary dysfunction, and sexual dysfunction (ie, impotence, dyspareunia, vaginal stenosis, vaginal dryness, reduced libido).[249-253] Anal cancer survivors also report significantly reduced global quality of life, with increased frequency of somatic symptoms including fatigue, dyspnea, nausea, appetite loss, pain, and insomnia.[249,253-255] Therefore, survivors of anal cancer should be screened regularly for distress.

The NCCN Guidelines for Survivorship provide screening, evaluation, and treatment recommendations for common consequences of cancer and cancer treatment to aid health care professionals who work with survivors of adult-onset cancer in the post-treatment period, including those in specialty cancer survivor clinics and primary care practices. These guidelines include many topics with potential relevance to survivors of anal cancer, including anxiety, depression, and distress; cognitive dysfunction; fatigue; pain; sexual dysfunction; sleep disorders; healthy lifestyles; and immunizations. Concerns related to employment, insurance, and disability are also discussed.

Summary

The NCCN Anal Carcinoma Guidelines Panel believes that a multidisciplinary approach including physicians from gastroenterology, medical oncology, surgical oncology, radiation oncology, and radiology is necessary for treating patients with anal carcinoma.

Recommendations for the primary treatment of perianal cancer and anal canal cancer are very similar and include chemoRT in most cases. The exception is small, well or moderately differentiated perianal lesions and superficially invasive lesions, which can be treated with margin-negative local excision alone. Follow-up clinical evaluations are recommended for all patients with anal carcinoma because additional curative-intent treatment is possible. Patients with biopsy-proven evidence of locally recurrent or persistent disease following primary treatment should undergo an APR with groin dissection if there is clinical evidence of inguinal nodal metastasis. Patients with a regional recurrence in the inguinal nodes can be treated with an inguinal node dissection, with consideration of RT with or without chemotherapy if no prior RT to the groin was given. Patients with evidence of extrapelvic metastatic disease should be treated with systemic therapy. The panel endorses the concept that treating patients in a clinical trial has priority over standard or accepted therapy.

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