Late Effects of Cancer Treatment
Screening and Surveillance Guidelines for GPs

Peter MacCallum Cancer Centre Late Effects Service July 2011

Adapted from the Children's Oncology Group Long-Term Follow-Up Guidelines (Oct 2008)

- 3.11 Combination chemotherapy
  - 3.11.1 CHOP
  - 3.11.2 ABVD
  - 3.11.3 MOPP
  - 3.11.4 BEAM
4. Radiotherapy
   - 4.1 Cranial irradiation
   - 4.2 Cranial irradiation>18Gy
   - 4.3 Cranial irradiation>30Gy
   - 4.4 Cranial irradiation>40Gy
   - 4.5 Neck irradiation
   - 4.6 Mantle radiotherapy
   - 4.7 Extended mantle radiotherapy
   - 4.8 Spinal irradiation
   - 4.9 Thoracic irradiation
   - 4.10 Abdominal irradiation
   - 4.11 Pelvic irradiation
   - 4.12 Musculoskeletal irradiation
   - 4.13 Total body irradiation
5. Autologous stem cell transplant
6. Allogenic stem cell transplant
7. Chronic graft vs. host disease (GVHD)
8. Surgery
   - 8.1 Amputation
   - 8.2 Central venous catheter
   - 8.3 Cystectomy
   - 8.4 Enucleation
   - 8.5 Hysterectomy
   - 8.6 Laparotomy
   - 8.7 Limb sparing procedure
   - 8.8 Nephrectomy
   - 8.9 Neurosurgery - brain
   - 8.10 Neurosurgery – spinal cord
   - 8.11 Oophoropexy
   - 8.12 Oophorectomy
   - 8.13 Orchidectomy
   - 8.14 Pelvic surgery/cystectomy
   - 8.15 Pulmonary surgery
   - 8.16 Splenectomy
   - 8.17 Thyroidectomy
9. Radioactive iodine thyroid ablation
10. Systemic MIBG

SUPPORTIVE CARE NEEDS IN LONG-TERM CANCER SURVIVORS

Potential late effects	Follow up recommendations
Psychosocial disorders • Social withdrawal • Educational difficulties **Mental health disorders** • Depression • Anxiety • Post-traumatic stress **Risk-taking behaviours** • Smoking • Alcohol • Substance abuse • Risk-taking sexual behaviour	**Yearly** psychosocial assessment (including smoking cessation advice) and as clinically indicated
Fatigue	Screen for physical causes: • Anaemia • Sleep disorders • Nutritional deficiencies • Cardiomyopathy • Pulmonary fibrosis • Hypothyroidism • Other endocrinopathy
Health promotion measures	General health advice and cancer screening recommendations should be emphasised Yearly advice should include: • Healthy diet • Exercise • Sun protection • General cancer screening measures, including BreastScreen, PAP tests, skin checks, prostate screening, Hep B and HPV immunization
Sexuality, sexual health and fertility	

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BLOOD PRODUCTS AND SERUM

Potential late effects	Considerations	Follow up recommendations
Iron overload	More likely in males. One off screening at first clinic assessment with iron studies (ferritin levels)	One off screening only required.
Received blood products prior to 1975: • Chronic Hepatitis B	Screening is recommended for all patients who underwent treatment for childhood cancer since the vast majority will have received blood products	• HBsAg (positive for carrier status if detected in two samples 6 months apart)
Received blood products prior to 1992: • Chronic Hepatitis C		• Hep C serology
Received blood products between 1977 and 1985: • HIV infection		• HIV serology

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CHEMOTHERAPY – general considerations.

In general, the potential for long-term side effects of any chemotherapy agent is greater if:

- Higher cumulative doses of the chemotherapeutic agent were given
- Multiple chemotherapeutic agents were administered which have similar long term effects
- The patient has coexisting medical conditions which predispose to that complication
- Radiotherapy was also administered to the area concerned
- Younger age at treatment in children
- Other risk factors coexist, such as smoking and alcohol

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BUSULFAN (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Pulmonary Fibrosis	Higher risk in smokers	• **Yearly** review (cough, SOB, wheeze) • CXR if clinically indicated • Lung function tests (incl. DLCO and spirometry) as clinically indicated
Cataracts	Higher risk if also received steroids and longer interval since treatment	• **Yearly** review for history of visual changes (decreased acuity, halos, diplopia) and eye examination (visual acuity, fundoscopy for lens opacity) • Consider Ophthalmology referral

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BCNU (CARMUSTINE) (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** review for symptoms (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Pulmonary Fibrosis	Higher risk in smokers	• **Yearly** review (cough, SOB, wheeze) • CXR if clinically indicated • Lung function tests (incl. DLCO and spirometry) as clinically indicated

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CHLORAMBUCIL (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy

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CYCLOPHOSPHAMIDE (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Urinary tract toxicity • Haemorrhagic cystitis • Bladder fibrosis • Dysfunctional voiding • Vesicoureteric reflux • Hydronephrosis	Higher risk if alcohol use or smoker	• **Yearly** history of urinary symptoms and urinalysis • Spot urine Ca^{++}/creatinine ratio if clinically indicated • Renal and UT USS if microscopic haematuria • Consider Urology/Renal referral if haematuria
Bladder malignancy	Higher risk if alcohol use or smoker	• **Yearly** history –(haematuria) and urinalysis • Renal and UT USS if microscopic haematuria as clinically indicated • Urology/renal referral if haematuria

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IFOSFAMIDE (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Urinary tract toxicity • Haemorrhagic cystitis • Bladder fibrosis • Dysfunctional voiding • Vesicoureteric reflux • Hydronephrosis	Higher risk if alcohol use or smoker	• **Yearly** history of urinary symptoms and urinalysis • Spot urine Ca^{++}/creatinine ratio if clinically indicated • Renal and UT USS if microscopic haematuria • Consider Urology/Renal referral if haematuria
Renal toxicity • Glomerular injury • Tubular injury (renal tubular acidosis, Fanconi's syndrome, hypophosphataemic rickets)		• **Yearly** BP, urinalysis • **Yearly** U&Es, Ca^{++}, MG^{++}, PO_4 • Renal referral if clinically indicated

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CCNU (LOMUSTINE) (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Pulmonary Fibrosis	Higher risk in smokers	• **Yearly** history – cough, SOB, wheeze • CXR if clinically indicated • Lung function tests (incl. DLCO and spirometry) as clinically indicated

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MELPHALAN (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy

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NITROGEN MUSTARD (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy

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PROCARBAZINE (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy

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THIOTEPA (Alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy

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DACARBAZINE (DTIC) (Non-classical alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy

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TEMOZOLOMIDE (Non-classical alkylating agent)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy

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CARBOPLATIN (Heavy metal)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Ototoxicity (in myeloablative doses) • Sensorineural hearing loss • Tinnitus • Vertigo	Higher risk if co-existent medical conditions – chronic ear infections, wax impaction, renal impairment	• **Yearly** history of hearing difficulties, tinnitus, vertigo • Otoscopy • Consider audiology assessment, ENT referral, speech therapy as clinically indicated
Peripheral neuropathy	Acute side effect of treatment which may have long-term sequelae	**Yearly** neurological examination until 2-3 years after treatment
Renal toxicity • Glomerular injury • Tubular injury • Renal impairment	Higher risk if one kidney, coexisting medical conditions – diabetes mellitus, HPT	• **Yearly** BP, urinalysis • **Yearly** U&Es, Ca^{++}, Mg^{++}, PO_4 • Consider renal referral if hypertensive, proteinuria or progressive renal impairment
Dyslipidaemia	Higher risk if family history, overweight/obese	• **Yearly** fasting lipids (total cholesterol, HDL, LDL, TG) • Consider lipid lowering agents if diet, exercise, reduction in alcohol and weight loss are insufficient

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CISPLATIN (Heavy metal)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Ototoxicity (in myeloablative doses) • Sensorineural hearing loss • Tinnitus • Vertigo	Higher risk if co-existent medical conditions – chronic ear infections, wax impaction, renal impairment	• **Yearly** history of hearing difficulties, tinnitus, vertigo • Otoscopy as clinically indicated • Consider audiology assessment, ENT referral, speech therapy as clinically indicated
Peripheral neuropathy	Acute side effect of treatment which may have long-term sequelae	**Yearly** neurological examination until 2-3 years after treatment
Renal toxicity • Glomerular injury • Tubular injury • Renal impairment	Higher risk if one kidney, coexisting medical conditions – diabetes mellitus, HPT	• **Yearly** BP, urinalysis • **Yearly** U&Es, Ca^{++}, Mg^{++}, PO_4 • Consider renal referral if hypertensive, proteinuria or progressive renal impairment
Dyslipidaemia	Higher risk if family history, overweight/obese	• **Yearly** fasting lipids (total cholesterol, HDL, LDL, TG) • Consider lipid lowering agents if diet, exercise, reduction in alcohol and weight loss are insufficient

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CYTARABINE (Antimetabolite)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Neurocognitive effects • Functional deficits • Learning deficits • Diminished IQ • Behavioural changes		• **Yearly** history – education and employment • Neuropsychology testing if clinically indicated
Clinical leukoencephalopathy • Spasticity • Ataxia • Dysarthria • Dysphagia • Hemiparesis • Seizures	Acute side effect of treatment which may have long-term sequelae	• **Yearly** history – cognitive, motor and/or sensory deficits; seizures; other neurological symptoms • **Yearly** neurological examination • Consider MRI/CT brain and neurology referral if clinically indicated

NB. Low dose Cytarabine is not known to have late effects.

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MERCAPTOPURINE (6MP) (Antimetabolite)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Hepatic dysfunction **Veno-occlusive disease**	Higher risk if co-existent viral hepatitis, previous veno-occlusive disease or siderosis	• Examination – scleral icterus/jaundice, ascites, hepatomegaly, splenomegaly as clinically indicated • LFTs and clotting profile if abnormal LFTs if clinically indicated • Consider viral hepatitis serology if persistently abnormal LFTs, particularly if patient received blood products prior to 1990

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THIOGUANINE (6TG) (Antimetabolite)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Hepatic dysfunction **Veno-occlusive disease**	Higher risk if co-existent viral hepatitis, previous veno-occlusive disease or siderosis	• Examination – scleral icterus/jaundice, ascites, hepatomegaly, splenomegaly as clinically indicated • LFTs and clotting profile if abnormal LFTs if clinically indicated • Consider viral hepatitis serology if persistently abnormal LFTs, particularly if patient received blood products prior to 1990

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METHOTREXATE (Antimetabolite)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Reduced bone mineral density	Higher risk if: • Lower weight and BMI • Corticosteroids (particularly if prolonged) • Smoking • Alcohol • Carbonated drinks • Medical conditions including growth hormone deficiency, hypogonadism/ delayed puberty, hyperthyroidism	Bone density studies as clinically indicated
Renal toxicity	Higher risk if one kidney, or co-existent medical conditions – diabetes mellitus, HPT	• **Yearly** BP and urinalysis • **Yearly** U&Es, Ca^{++}, MG^{++}, PO_4 • Consider renal referral if hypertensive, proteinuria or progressive renal impairment
Hepatic dysfunction	Higher risk if co-existent viral hepatitis	• Examination – scleral icterus/jaundice, ascites, hepatomegaly, splenomegaly as clinically indicated • LFTs and clotting profile if abnormal LFTs if clinically indicated • Consider viral hepatitis serology if persistently abnormal LFTs, particularly if patient received blood products prior to 1990
Neurocognitive effects • Functional deficits • Learning deficits • Diminished IQ • Behavioural changes		• **Yearly** history – education and employment • Neuropsychology testing if clinically indicated
Clinical leukoencephalopathy • Spasticity • Ataxia • Dysarthria • Dysphagia • Hemiparesis • Seizures	Acute side effect of treatment which may have long-term sequelae	• **Yearly** history – cognitive, motor and/or sensory deficits; seizures; other neurological symptoms • **Yearly** neurological examination • Consider MRI/CT brain and neurology referral if clinically indicated

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DAUNORUBICIN (Anthracycline antibiotic)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Acute myeloid leukaemia		• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Cardiac toxicity • Cardiomyopathy • Arrhythmias • Subclinical left ventricular dysfunction	Higher risk if coexisting medical conditions – obesity, congenital heart disease, febrile illness; smokers; drug abuse	• **Yearly** history – SOB, orthopnoea, chest pain, palpitations – and cardiac examination • ECG and echocardiography (see specific recommendations for frequency) • Advise patients with prolonged QT interval about the use of medications which may further prolong the QT interval (eg TCAs, antifungals, macrolide ABs, metronidazole) • Reduce cardiac risk – weight, BP, diet, exercise • Seek cardiac opinion if pregnant or planning a pregnancy

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DOXORUBICIN (Anthracycline antibiotic)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Acute myeloid leukaemia		• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Cardiac toxicity • Cardiomyopathy • Arrhythmias • Subclinical left ventricular dysfunction	Higher risk if coexisting medical conditions – obesity, congenital heart disease, febrile illness; smokers; drug abuse	• **Yearly** history – SOB, orthopnoea, chest pain, palpitations – and cardiac examination • ECG and echocardiography (see specific recommendations for frequency) • Advise patients with prolonged QT interval about the use of medications which may further prolong the QT interval (eg TCAs, antifungals, macrolide ABs, metronidazole) • Reduce cardiac risk – weight, BP, diet, exercise • Seek cardiac opinion if pregnant or planning a pregnancy

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EPIRUBICIN (Anthracycline antibiotic)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Acute myeloid leukaemia		• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Cardiac toxicity • Cardiomyopathy • Arrhythmias • Subclinical left ventricular dysfunction	Higher risk if coexisting medical conditions – obesity, congenital heart disease, febrile illness; smokers; drug abuse	• **Yearly** history – SOB, orthopnoea, chest pain, palpitations – and cardiac examination • ECG and echocardiography (see specific recommendations for frequency) • Advise patients with prolonged QT interval about the use of medications which may further prolong the QT interval (eg TCAs, antifungals, macrolide ABs, metronidazole) • Reduce cardiac risk – weight, BP, diet, exercise • Seek cardiac opinion if pregnant or planning a pregnancy

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IDARUBICIN (Anthracycline antibiotic)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Acute myeloid leukaemia		• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Cardiac toxicity • Cardiomyopathy • Arrhythmias • Subclinical left ventricular dysfunction	Higher risk if coexisting medical conditions – obesity, congenital heart disease, febrile illness; smokers; drug abuse	• **Yearly** history – SOB, orthopnoea, chest pain, palpitations – and cardiac examination • ECG and echocardiography (see specific recommendations for frequency) • Advise patients with prolonged QT interval about the use of medications which may further prolong the QT interval (eg TCAs, antifungals, macrolide ABs, metronidazole) • Reduce cardiac risk – weight, BP, diet, exercise • Seek cardiac opinion if pregnant or planning a pregnancy

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MITOXANTRONE (Anthracycline antibiotic)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Acute myeloid leukaemia		• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Cardiac toxicity • Cardiomyopathy • Arrhythmias • Subclinical left ventricular dysfunction	Higher risk if coexisting medical conditions – obesity, congenital heart disease, febrile illness; smokers; drug abuse	• **Yearly** history – SOB, orthopnoea, chest pain, palpitations – and cardiac examination • ECG and echocardiography (see specific recommendations for frequency) • Advise patients with prolonged QT interval about the use of medications which may further prolong the QT interval (eg TCAs, antifungals, macrolide ABs, metronidazole) • Reduce cardiac risk – weight, BP, diet, exercise • Seek cardiac opinion if pregnant or planning a pregnancy

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BLEOMYCIN (Anti-tumour antibiotic)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Pulmonary toxicity • Interstitial pneumonitis • Pulmonary fibrosis • Acute respiratory distress syndrome	Higher risk if coexistent medical conditions – renal dysfunction, high dose 0_2 eg during GA, and in smokers	• **Yearly** history – cough, SOB, wheeze • CXR if clinically indicated • **5 yearly** lung function tests (incl. DLCO and spirometry) or as clinically indicated

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ACTINOMYCIN (Anti-tumour antibiotic)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning

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DEXAMETHASONE (Corticosteroid)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Reduced bone mineral density	Higher risk if: • Lower weight and BMI • Smoking • Alcohol • Carbonated drinks • Co-existing medical conditions – growth hormone deficiency, hypogonadism/ delayed puberty, hyperthyroidism	Bone density studies as clinically indicated
Avascular necrosis Typically occurs during acute treatment phase; may progress or resolve over time	Higher risk associated with sickle cell disease	• **Yearly** history – joint pain or swelling, immobility, decreased ROM and physical examination • Consider orthopaedic referral and MRI if clinically indicated
Cataracts		• **Yearly** history –visual changes (decreased acuity, halos, diplopia), and eye examination (acuity, fundoscopy for lens opacity) • Consider ophthalmology referral

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PREDNISOLONE (Corticosteroid)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Reduced bone mineral density	Higher risk if: • Lower weight and BMI • Smoking • Alcohol • Carbonated drinks • Co-existing medical conditions – growth hormone deficiency, hypogonadism/ delayed puberty, hyperthyroidism	Bone density studies as clinically indicated
Avascular necrosis Typically occurs during acute treatment phase; may progress or resolve over time	Higher risk associated with sickle cell disease	• **Yearly** history – joint pain or swelling, immobility, decreased ROM and physical examination • Consider orthopaedic referral and MRI if clinically indicated
Cataracts		• **Yearly** history –visual changes (decreased acuity, halos, diplopia), and eye examination (acuity, fundoscopy for lens opacity) • Consider ophthalmology referral

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ASPARAGINASE (Enzyme)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning

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VINBLASTINE (Plant alkyloid)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Peripheral sensory or motor neuropathy • Areflexia • Weakness • Foot drop • Paraesthesiae	Acute side effect of treatment which may have long-term sequelae Higher risk if coexisting anorexia or severe weight loss, or Charcot-Marie-Tooth disease	**Yearly** history and neurological examination until 2-3 years post therapy (typically not late in onset).
Reynaud's phenomenon	Higher risk if smoker or illicit drug use eg cocaine	• **Yearly** history and examination – vasospasm of hands, feet, nose, lips, cheeks or earlobes related to stress or exposure to cold • Advice re appropriate clothing, smoking, drugs • Consider vasodilators (calcium channel blockers, alpha blockers)

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VINCRISTINE (Plant alkyloid)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Peripheral sensory or motor neuropathy • Areflexia • Weakness • Foot drop • Paraesthesiae	Acute side effect of treatment which may have long-term sequelae Higher risk if coexisting anorexia or severe weight loss, or Charcot-Marie-Tooth disease	**Yearly** history and neurological examination until 2-3 years post therapy (typically not late in onset).
Reynaud's phenomenon	Higher risk if smoker or illicit drug use eg cocaine	• **Yearly** history and examination – vasospasm of hands, feet, nose, lips, cheeks or earlobes related to stress or exposure to cold • Advice re appropriate clothing, smoking, drugs • Consider vasodilators (calcium channel blockers, alpha blockers)

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ETOPOSIDE (VP16) (Epipodophyllotoxin)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• Yearly oral examination • 6 monthly dental check up and cleaning
Acute myeloid leukaemia	Higher risk if splenectomised, treatment prior to 1990 or less than 5 years since treatment	• Yearly history – fatigue, bleeding, easy bruising; and examination – pallor, petechiae, purpura • Yearly FBE and film up to 10 years post treatment. • Bone marrow aspirate if clinically indicated

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TENIPOSIDE (VM26) (Epipodophyllotoxin)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• Yearly oral examination • 6 monthly dental check up and cleaning
Acute myeloid leukaemia	Higher risk if splenectomised, treatment prior to 1990 or less than 5 years since treatment	• Yearly history – fatigue, bleeding, easy bruising; and examination – pallor, petechiae, purpura • Yearly FBE and film up to 10 years post treatment. • Bone marrow aspirate if clinically indicated

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CHOP combination chemotherapy
(Doxorubicin, Cyclophosphamide, Vincristine, Prednisolone)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Cardiac toxicity • Cardiomyopathy • Arrhythmias • Subclinical left ventricular dysfunction	Higher risk if coexisting medical conditions – obesity, congenital heart disease, febrile illness; smokers; drug abuse	• **Yearly** history – SOB, orthopnoea, chest pain, palpitations – and cardiac examination • ECG and echocardiography (see specific recommendations for frequency) • Advise patients with prolonged QT interval about the use of medications which may further prolong the QT interval (eg TCAs, antifungals, macrolide ABs, metronidazole) • Reduce cardiac risk – weight, BP, diet, exercise • Seek cardiac opinion if pregnant or planning a pregnancy
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Urinary tract toxicity • Haemorrhagic cystitis • Bladder fibrosis • Dysfunctional voiding • Vesicoureteric reflux • Hydronephrosis	Higher risk if alcohol use or smoker	• **Yearly** history of urinary symptoms and urinalysis • Spot urine Ca^{++}/creatinine ratio if clinically indicated • Renal and UT USS if microscopic haematuria • Consider Urology/Renal referral if haematuria
Bladder malignancy	Higher risk if alcohol use or smoker	• **Yearly** history –(haematuria) and urinalysis • Renal and UT USS if microscopic haematuria as clinically indicated • Urology/renal referral if haematuria
Peripheral sensory or motor neuropathy • Areflexia • Weakness • Foot drop • Paraesthesiae	Acute side effect of treatment which may have long-term sequelae Higher risk if coexisting anorexia or severe weight loss, or Charcot-Marie-Tooth disease	**Yearly** history and neurological examination until 2-3 years post therapy (typically not late in onset).

Reynaud's phenomenon	Higher risk if smoker or illicit drug use eg cocaine	• Yearly history and examination – vasospasm of hands, feet, nose, lips, cheeks or earlobes related to stress or exposure to cold • Advice re appropriate clothing, smoking, drugs • Consider vasodilators (calcium channel blockers, alpha blockers)
Reduced bone mineral density	Higher risk if: • Lower weight and BMI • Smoking • Alcohol • Carbonated drinks • Co-existing medical conditions – growth hormone deficiency, hypogonadism/ delayed puberty, hyperthyroidism	Bone density studies as clinically indicated
Avascular necrosis Typically occurs during acute treatment phase; may progress or resolve over time	Higher risk associated with sickle cell disease	• Yearly history – joint pain or swelling, immobility, decreased ROM and physical examination • Consider orthopaedic referral and MRI if clinically indicated
Cataracts		• Yearly history –visual changes (decreased acuity, halos, diplopia), and eye examination (acuity, fundoscopy for lens opacity) • Consider ophthalmology referral

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ABVD combination chemotherapy
(Bleomycin, Dacarbazine, Adriamycin, Vinblastine)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Pulmonary toxicity • Interstitial pneumonitis • Pulmonary fibrosis • Acute respiratory distress syndrome	Higher risk if coexistent medical conditions – renal dysfunction, high dose 0_2 eg during GA, and in smokers	• **Yearly** history – cough, SOB, wheeze • CXR if clinically indicated • **5 yearly** lung function tests (incl. DLCO and spirometry) or as clinically indicated
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Cardiac toxicity • Cardiomyopathy • Arrhythmias • Subclinical left ventricular dysfunction	Higher risk if coexisting medical conditions – obesity, congenital heart disease, febrile illness; smokers; drug abuse	• **Yearly** history – SOB, orthopnoea, chest pain, palpitations – and cardiac examination • ECG and echocardiography (see specific recommendations for frequency) • Advise patients with prolonged QT interval about the use of medications which may further prolong the QT interval (eg TCAs, antifungals, macrolide ABs, metronidazole) • Reduce cardiac risk – weight, BP, diet, exercise • Seek cardiac opinion if pregnant or planning a pregnancy
Peripheral sensory or motor neuropathy • Areflexia • Weakness • Foot drop • Paraesthesiae	Acute side effect of treatment which may have long-term sequelae Higher risk if coexisting anorexia or severe weight loss, or Charcot-Marie-Tooth disease	**Yearly** history and neurological examination until 2-3 years post therapy (typically not late in onset).

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MOPP combination chemotherapy
(Nitrogen Mustard, Prednisolone, Vincristine, Procarbazine)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy	• **Yearly** history (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy
Reduced bone mineral density	Higher risk if: • Lower weight and BMI • Smoking • Alcohol • Carbonated drinks • Co-existing medical conditions – growth hormone deficiency, hypogonadism/ delayed puberty, hyperthyroidism	Bone density studies as clinically indicated
Avascular necrosis Typically occurs during acute treatment phase; may progress or resolve over time	Higher risk associated with sickle cell disease	• **Yearly** history – joint pain or swelling, immobility, decreased ROM and physical examination • Consider orthopaedic referral and MRI if clinically indicated
Cataracts		• **Yearly** history –visual changes (decreased acuity, halos, diplopia), and eye examination (acuity, fundoscopy for lens opacity) • Consider ophthalmology referral
Peripheral sensory or motor neuropathy • Areflexia • Weakness • Foot drop • Paraesthesiae	Acute side effect of treatment which may have long-term sequelae Higher risk if coexisting anorexia or severe weight loss, or Charcot-Marie-Tooth disease	**Yearly** history and neurological examination until 2-3 years post therapy (typically not late in onset).

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BEAM combination chemotherapy (BCNU, Etoposide, Melphalan, Ara-C)

Potential late effects	Considerations	Follow up recommendations
Dental abnormalities • Tooth/root agenesis • Root thinning/shortening • Enamel dysplasia	Patient at higher risk of problems if they received any radiotherapy involving the oral cavity or salivary glands	• **Yearly** oral examination • **6 monthly** dental check up and cleaning
Testicular dysfunction: • Delayed/arrested puberty • Hypogonadism • Oligospermia • Azoospermia • Infertility	Higher risk in smokers NB. Resumption of spermatogenesis can occur up to 10 years post therapy.	• **Yearly** FSH, LH, testosterone • Semen analysis if requested • Consider bone density in hypogonadal patients • Endocrinology/urology referral as clinically indicated • Reproductive endocrinology/ urology referral for infertility
Ovarian dysfunction: • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk in smokers NB. Advise menstruating women of the increased risk of early menopause and to be cautious of delaying childbearing. Recovery of fertility can occur years after therapy.	• **Yearly** FSH, LH, Oestradiol • Consider bone density in hypogonadal patients • Endocrinology/gynaecology referral as clinically indicated • Reproductive endocrinology referral for infertility
Acute myeloid leukaemia **Myelodysplasia**	Higher risk if <10 years since chemotherapy, splenectomised, or treatment prior to 1990	• **Yearly** review for symptoms (fatigue, bleeding, easy bruising) and examination (pallor, petichiae, purpura) • **Yearly** FBE until 10 years after chemotherapy • Bone marrow aspirate if clinically indicated
Pulmonary Fibrosis	Higher risk in smokers	• **Yearly** review (cough, SOB, wheeze) • CXR if clinically indicated • Lung function tests (incl. DLCO and spirometry) as clinically indicated
Neurocognitive effects • Functional deficits • Learning deficits • Diminished IQ • Behavioural changes		• **Yearly** history – education and employment • Neuropsychology testing if clinically indicated
Clinical leukoencephalopathy • Spasticity • Ataxia • Dysarthria • Dysphagia • Hemiparesis • Seizures	Acute side effect of treatment which may have long-term sequelae	• **Yearly** history – cognitive, motor and/or sensory deficits; seizures; other neurological symptoms • **Yearly** neurological examination • Consider MRI/CT brain and neurology referral if clinically indicated

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RADIOTHERAPY - General considerations influencing radiation toxicity:

- Anatomical region exposed - this may include areas other than the target organ involved.
- The amount of radiation given - this is dependent on the cumulative dose (including boost dose) and daily fraction size
- Patient's age at time of radiotherapy. In general, the younger the patient is at the time of treatment, the greater the risk of radiation toxicity.
- Type of radiation used. Orthovoltage radiotherapy (commonly given prior to 1970) delivers a higher radiation dose to skin and bones, hence increasing the risk of secondary skin and bone malignancies.
- Toxicity may not be manifest until growth is completed or the patient ages.

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CRANIAL IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Brain tumours • Thyroid nodules • Thyroid cancer	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Brain tumour – benign or malignant	Higher risk in patients who have neurofibromatosis	• **Yearly** history – headaches; vomiting; cognitive, motor or sensory deficits; seizures or other neurological symptoms; and neurological examination • MRI: initially annually, then every 2 years once stable and as clinically indicated • Patients with neurofibromatosis: MRI every 2 years commencing 2 years after radiotherapy
Neurocognitive deficits • Functional deficits in planning and organization, sustained attention, memory, processing speed and visual-motor integration • Learning deficits (maths and reading) • Lowered IQ • Behavioural changes	Highest risk if: • Age< 3 years at time of treatment • Females • Supratentorial tumour • Premorbid or family history of learning or attention problems	• **Yearly** review of education and employment • Neuropsychological testing if clinically indicated
Clinical leukoencephalopathy • Spasticity • Ataxia • Dysarthria • Dysphagia • Hemiparesis • Seizures	Acute side effect of treatment which may have long-term sequelae	• **Yearly** history of cognitive, motor and/or sensory deficits; seizures; other neurological symptoms • **Yearly** neurological examination • Brain MRI, and CT with MR angiography as clinically indicated • Neurology referral and follow-up as clinically indicated
Craniofacial abnormalities		• **Yearly** history and examination– education and employment, depression, anxiety, post-traumatic stress, social withdrawal • Consider referral to faciomaxillary surgery

Chronic sinusitis	Higher risk if history of atopy or hypogammaglobulinaemia	• **Yearly** history and examination– rhinorrhoea, post-nasal discharge • CT sinuses and ENT referral if clinically indicated
Obesity	Higher risk if: • Combination with corticosteroids • Family history of dyslipidaemia • Growth hormone deficiency • Hypothyroidism • Age <4 years at treatment • Females • Inability to exercise due to medical condition • Surgery to hypothalamus or pituitary	• **Yearly** BMI and BP • Fasting blood glucose and lipids (HDL, LDL, TGs) **every 2 years** or as clinically indicated • Consider Endocrine review
Metabolic syndrome • Central obesity • HPT • Dyslipidaemia • Abnormal glucose metabolism	Higher risk if: • Growth hormone deficiency • Hypogonadism • Surgery in suprasellar region • Obese	• **Yearly** BMI and BP • Fasting blood glucose and lipids (HDL, LDL, TGs) **every 2 years** or as clinically indicated • Consider Endocrine review
Central hypothyroidism (TRH and TSH deficiency)		• **Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry skin and hair, depressed mood • **Yearly** examination – weight, height, hair, skin, thyroid • **Yearly** TSH, **free** T4 NB: Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Gonadotropin deficiency (LH and FSH deficiency)		**Males:** As clinically indicated: • History of sexual function • FSH, LH, testosterone • Semen analysis • Endocrine review • Reproductive endocrinology referral • Bone density if gonadotropin deficient **Females:** As clinically indicated: • Menstrual and pregnancy history; libido • FSH, LH, oestradiol • Endocrine review • Reproductive endocrinology referral • Bone density if gonadotropin deficient • Consider HRT
Central adrenal insufficiency	Higher risk if: • Surgery/tumour in the suprasellar region • Prior development of another hypothalamic-pituitary endocrinopathy	• **Yearly** history – anorexia, dehydration, hypoglycaemia, lethargy • **Yearly** BP • Morning serum cortisol and endocrine review as clinically indicated
Hyperprolactinaemia	Higher risk if surgery/tumour in hypothalamic area	**Males:** • **Yearly** history -decreased libido, galactorrhoea • Serum PRL if indicated • CT to exclude pituitary adenoma if indicated • Endocrine review if clinically indicated **Females:** • **Yearly** history – galactorrhoea, menstrual history (amenorrhoea) • Serum PRL if indicated • CT (exclude pituitary adenoma) if

		indicated • Endocrine review if clinically indicated
Growth hormone deficiency	Higher risk if surgery/tumour in hypothalamic area	• **Yearly** nutritional assessment and BMI • TFTs as clinically indicated • Bone mineral density as clinically indicated in those with GH deficiency • Endocrine mandatory if suspected
Precocious puberty	**Males** Higher risk if younger age at treatment	• **Yearly** weight, height, Tanner staging and testicular volume by Prader orchidometry until sexually mature • FSH, LH, and testosterone as clinically indicated • XR for bone age in rapidly growing children as clinically indicated • Endocrine review as clinically indicated
	Females Higher risk younger age at treatment	• **Yearly** weight, height, Tanner staging until sexually mature • FSH, LH, and testosterone as clinically indicated • XR for bone age in rapidly growing children as clinically indicated • Endocrine review as clinically indicated • Pelvic USS (exclude ovarian tumour) if clinically indicated
Cataracts		• **Yearly** history – visual changes (decreased acuity, halos, diplopia) and examination – visual acuity, fundoscopy • **Yearly** Ophthalmology review for patients with ocular tumours and those who received TBI or >30Gy cranial/orbital/eye radiation, or **every 3 years** for patients without ocular tumours who received <30Gy
Xerostomia Salivary gland dysfunction		• **Yearly** history and examination • **6 monthly** dental examination
Dental abnormalities • Tooth/root agenesis • Microdontia • Root thinning/shortening • Enamel dysplasia • Periodontal disease • Dental caries • Malocclusion • Temporomandibular joint dysfunction	Higher risk if younger age at treatment, particularly <5 years, or in Gorlin's syndrome	**6 monthly** dental examination
Thyroid nodules	Higher risk in females	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA
Thyroid cancer	Higher risk in females and >5 years after irradiation	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA • **Refer immediately** if suspicious nodule on thyroid USS

Hypothyroidism	Higher risk in females	• Yearly history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; and examination – height, weight, hair, skin, thyroid • Yearly TSH, Free T4 and as clinically indicated NB. Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones

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CRANIAL IRRADIATION ≥18Gy OR COMBINATION WITH TBI TOTALLING ≥18Gy As above for cranial irradiation and additionally:		
Potential late effects	Considerations	Follow up recommendations
Cerebrovascular complications • Stroke • Moyamoya syndrome (progressive occlusion of the cerebral vessels, particularly the Circle of Willis) • Occlusive cerebral vasculopathy	Higher risk if: • Down Syndrome • Sickle cell disease • Neurofibromatosis	• **Yearly** history – Hemiparesis, hemiplegia, weakness, aphasia; and neurological examination • MRI and neurology/neurosurgery referral and follow up as clinically indicated

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CRANIAL IRRADIATION ≥30Gy OR COMBINATION WITH TBI TOTALLING ≥30Gy As above for cranial irradiation and additionally:		
Potential late effects	Considerations	Follow up recommendations
Ocular toxicity • Orbital hypoplasia • Lacrimal duct atrophy • Xerophthalmia (keratoconjunctivitis sicca) • Keratitis • Telangectasiae • Retinopathy • Optic chiasm neuropathy • Enopthalmos • Chronic painful eye • Maculopathy • Papillopathy • Glaucoma	Higher risk if chronic graft vs host disease, or ocular tumour eg retinoblastoma	• **Yearly** history – visual changes, dry eye, persistent eye irritation, excessive tearing, light sensitivity, poor night vision, painful eye; and eye examination – visual acuity, fundoscopy • **Yearly** Ophthalmology review
Ototoxicity • Tympanosclerosis • Otosclerosis • Eustachian tube dysfunction • Conductive hearing loss	Higher risk if: • Younger age at treatment • Medical conditions – chronic otitis, chronic wax impaction	• **Yearly** history – hearing difficulties, vertigo, tinnitus; and otoscopy • Consider ENT referral • Audiology **yearly for 5 years** after completion of therapy, then **every 5 years** or as clinically indicated
Sensorineural hearing loss Tinnitus	Higher risk if: • Younger age at treatment • CNS tumour • CSF shunting	

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CRANIAL IRRADIATION ≥40Gy OR COMBINATION WITH TBI TOTALLING ≥40Gy As above for cranial irradiation and additionally:		
Potential late effects	Considerations	Follow up recommendations
Hyperprolactinaemia	Higher risk if: • Higher radiation dose • Tumour or surgery in the hypothalamic region	• **Yearly** history – galactorrhoea; decreased libido in men; menstrual disturbance in women • PRL if clinically indicated

Central hypothyroidism	Higher risk with higher radiation dose	• Yearly history – fatigue, weight gain, cold intolerance, constipation, dry skin, brittle hair, depressed mood; and examination - height, weight, hair, skin, thyroid exam • Yearly TFTs (TSH, free T4) • Endocrine review if clinically indicated Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Gonadotropin deficiency	Males Higher risk with higher radiation dose	• Yearly history – puberty, sexual function • Yearly FSH, LH, testosterone • Semen analysis on request • Endocrinology review as clinically indicated • Reproductive endocrinology review as clinically indicated • Bone density as clinically indicated
	Females Higher risk with higher radiation dose	• Yearly history – puberty, menstrual/pregnancy history, sexual function • Yearly FSH, LH, Oestradiol • Endocrinology review as clinically indicated • Reproductive endocrinology review on request • Bone density if clinically indicated
Central adrenal insufficiency	Higher risk if: • Higher radiation dose • Surgery or tumour in the suprasellar region	• Yearly history – FTT, anorexia, dehydration, hypoglycaemia, lethargy, unexplained hypotension • Yearly 8am serum cortisol for at least 15 years after treatment and as clinically indicated • Endocrine review as clinically indicated
Osteoradionecrosis	Higher risk if administered bisphosphonates	• History and examination – impaired healing following dental work, jaw pain or swelling, trismus- as clinically indicated • Imaging (XR, CT and/or MRI) as clinically indicated
Hyperthyroidism	Higher risk with higher radiation dose	• Yearly history – heat intolerance, tachycardia/palpitations, weight loss, emotional lability, muscular weakness, hyperphagia; and examination – eyes, skin, thyroid, cardiac, neurological examination • Yearly TSH, Free T4 or as clinically indicated • Endocrine review essential if clinically indicated
Carotid artery disease		• Yearly history – memory impairment; and examination – carotid bruits, neurological exam • Baseline carotid USS 10 years post radiotherapy, and as clinically indicated

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NECK IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Thyroid nodules • Thyroid cancer	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Xerostomia **Salivary gland dysfunction**		• **Yearly** history and examination • **6 monthly** dental examination
Dental abnormalities • Tooth/root agenesis • Microdontia • Root thinning/shortening • Enamel dysplasia • Periodontal disease • Dental caries • Malocclusion • Temporomandibular joint dysfunction	Higher risk if younger age at treatment, particularly <5 years, or in Gorlin's syndrome	**6 monthly** dental examination
Osteoradionecrosis **(if ≥40Gy)**	Higher risk if administered bisphosphonates	• **History** and examination – impaired healing following dental work, jaw pain or swelling, trismus- as clinically indicated • Imaging (XR, CT and/or MRI) as clinically indicated
Thyroid nodules	Higher risk in females	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA
Thyroid cancer	Higher risk in females and >5 years after irradiation	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA • **Refer immediately** if suspicious nodule on thyroid USS

Hypothyroidism	Higher risk in females	• **Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; and examination – height, weight, hair, skin, thyroid • **Yearly** TSH, Free T4 NB. Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Hyperthyroidism (if ≥40Gy)	Higher risk with higher radiation dose	• **Yearly** history – heat intolerance, tachycardia/palpitations, weight loss, emotional lability, muscular weakness, hyperphagia; and examination – eyes, skin, thyroid, cardiac, neurological examination • **Yearly** TSH, Free T4 or as clinically indicated • Endocrine review essential if clinically indicated
Carotid artery disease (if ≥40Gy)		• **Yearly** history – memory impairment; and examination – carotid bruits, neurological exam • Baseline carotid USS 10 years post radiotherapy, and as clinically indicated
Subclavian artery disease (If ≥40Gy)		• **Yearly** examination - brachial and radial pulses; pallor upper limbs; cool skin; unequal BP • Baseline Doppler USS 10 years post radiotherapy, and as clinically indicated
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Radiation-induced fracture (If ≥40Gy)	Higher risk if history of surgery to bone cortex	• Examination – pain, swelling, deformity – and XR as clinically indicated
Oesophageal stricture (If ≥30Gy)	Higher risk if gastroesophageal reflux or history of Candida oesophagitis	• **Yearly** history – dysphagia, reflux

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MANTLE RADIOTHERAPY

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Thyroid nodules • Thyroid cancer • Breast cancer	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Xerostomia **Salivary gland dysfunction**		• **Yearly** history and examination • **6 monthly** dental examination
Dental abnormalities • Tooth/root agenesis • Microdontia • Root thinning/shortening • Enamel dysplasia • Periodontal disease • Dental caries • Malocclusion • Temporomandibular joint dysfunction	Higher risk if younger age at treatment, particularly <5 years, or in Gorlin's syndrome	**6 monthly** dental examination
Osteoradionecrosis **(if ≥40Gy)**	Higher risk if administered bisphosphonates	• **History** and examination – impaired healing following dental work, jaw pain or swelling, trismus- as clinically indicated • Imaging (XR, CT and/or MRI) as clinically indicated
Thyroid nodules	Higher risk in females	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA
Thyroid cancer	Higher risk in females and >5 years after irradiation	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA • **Refer immediately** if suspicious nodule on thyroid USS

Hypothyroidism	Higher risk in females	• **Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; and examination – height, weight, hair, skin, thyroid • **Yearly** TSH, Free T4 NB. Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Hyperthyroidism (if ≥40Gy)	Higher risk with higher radiation dose	• **Yearly** history – heat intolerance, tachycardia/palpitations, weight loss, emotional lability, muscular weakness, hyperphagia; and examination – eyes, skin, thyroid, cardiac, neurological examination • **Yearly** TSH, Free T4 or as clinically indicated • Endocrine review essential if clinically indicated
Carotid artery disease (if ≥40Gy)		• **Yearly** history – memory impairment; and examination – carotid bruits, neurological exam • Baseline carotid USS 10 years post radiotherapy, and as clinically indicated
Subclavian artery disease (If ≥40Gy)		• **Yearly** examination - brachial and radial pulses; pallor upper limbs; cool skin; unequal BP • Baseline Doppler USS 10 years post radiotherapy, and as clinically indicated
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Breast cancer (If ≥20Gy)	Higher risk if family history of breast cancer and longer time since radiation (•5 years)	• **Yearly** breast examination • **Yearly** mammography/breast USS beginning 8 years after radiotherapy
Breast tissue hypoplasia	Higher risk if prepubertal at time of breast radiation	**Yearly** breast examination
Pulmonary toxicity • Pulmonary fibrosis • Interstitial pneumonitis • Restrictive lung disease • COAD	Higher risk if atopic and in smokers	• **Yearly** history – cough, SOB, exertional dyspnoea, wheeze – and examination • **Yearly** CXR • PFTs as clinically indicated
Oesophageal stricture (If ≥30Gy)	Higher risk if gastroesophageal reflux or history of Candida oesophagitis	• **Yearly** history – dysphagia, reflux
Cardiac toxicity • CCF • Cardiomyopathy • Pericarditis • Pericardial fibrosis • Valvular disease • MI • Arrhythmias • IHD	Higher risk if: • Familial hypercholesterolaemia • IHD or coronary risk factors including smoking • Febrile illness • Pregnancy or untreated premature ovarian failure in women Highest risk if: • Age under 5 at treatment • Longer interval since treatment	• **Yearly** history – chest pain, SOB, exertional dyspnoea, orthopnoea, palpitations – and cardiac examination • **Yearly** fasting lipids and BGL As clinically indicated and according to risk factors: • ECG • Echocardiography • Cardiology review
Scoliosis	Highest risk with orthovoltage radiation (commonly given before 1970)	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral

Kyphosis	Highest risk with orthovoltage radiation (commonly given before 1970) Higher risk if patient has neurofibromatosis	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Radiation-induced fracture (If ≥40Gy)	Higher risk if history of surgery to bone cortex	Examination – pain, swelling, deformity – and XR as clinically indicated

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EXTENDED MANTLE RADIOTHERAPY

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Thyroid nodules • Thyroid cancer • Breast cancer • Colon cancer	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Xerostomia **Salivary gland dysfunction**		• **Yearly** history and examination • **6 monthly** dental examination
Dental abnormalities • Tooth/root agenesis • Microdontia • Root thinning/shortening • Enamel dysplasia • Periodontal disease • Dental caries • Malocclusion • Temporomandibular joint dysfunction	Higher risk if younger age at treatment, particularly <5 years, or in Gorlin's syndrome	**6 monthly** dental examination
Osteoradionecrosis **(if ≥40Gy)**	Higher risk if administered bisphosphonates	• **History** and examination – impaired healing following dental work, jaw pain or swelling, trismus- as clinically indicated • Imaging (XR, CT and/or MRI) as clinically indicated
Thyroid nodules	Higher risk in females	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA
Thyroid cancer	Higher risk in females and >5 years after irradiation	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA • **Refer immediately** if suspicious nodule

		on thyroid USS
Hypothyroidism	Higher risk in females	• **Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; and examination – height, weight, hair, skin, thyroid • **Yearly** TSH, Free T4 NB. Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Hyperthyroidism (if ≥40Gy)	Higher risk with higher radiation dose	• **Yearly** history – heat intolerance, tachycardia/palpitations, weight loss, emotional lability, muscular weakness, hyperphagia; and examination – eyes, skin, thyroid, cardiac, neurological examination • **Yearly** TSH, Free T4 and if clinically indicated • Endocrine review essential if clinically indicated
Carotid artery disease (if ≥40Gy)		• **Yearly** history – memory impairment; and examination – carotid bruits, neurological exam • Baseline carotid USS 10 years post radiotherapy, and as clinically indicated
Subclavian artery disease (If ≥40Gy)		• **Yearly** examination - brachial and radial pulses; pallor upper limbs; cool skin; unequal BP • Baseline Doppler USS 10 years post radiotherapy, and as clinically indicated
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Breast cancer (If ≥20Gy)	Higher risk if family history of breast cancer and longer time since radiation (>5 years)	• **Yearly** breast examination • **Yearly** mammography/breast USS beginning 8 years after radiotherapy
Breast tissue hypoplasia	Higher risk if prepubertal at time of breast radiation	**Yearly** breast examination
Pulmonary toxicity • Pulmonary fibrosis • Interstitial pneumonitis • Restrictive lung disease • COAD	Higher risk if atopic and in smokers	• **Yearly** history – cough, SOB, exertional dyspnoea, wheeze – and examination • **Yearly** CXR • PFTs as clinically indicated
Oesophageal stricture (If ≥30Gy)	Higher risk if gastroesophageal reflux or history of Candida oesophagitis	• **Yearly** history – dysphagia, reflux
Cardiac toxicity • CCF • Cardiomyopathy • Pericarditis • Pericardial fibrosis • Valvular disease • MI • Arrhythmias • IHD	Higher risk if: • Familial hypercholesterolaemia • IHD or coronary risk factors including smoking • Febrile illness • Pregnancy or untreated premature ovarian failure in women Highest risk if: • Age under 5 at treatment	• **Yearly** history – chest pain, SOB, exertional dyspnoea, orthopnoea, palpitations – and cardiac examination • **Yearly** fasting lipids and BGL As clinically indicated and according to risk factors: • ECG • Echocardiography • Cardiology review

	• Longer interval since treatment	
Scoliosis	Highest risk with orthovoltage radiation (commonly given before 1970)	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Kyphosis	Highest risk with orthovoltage radiation (commonly given before 1970) Higher risk if patient has neurofibromatosis	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Radiation-induced fracture (If ≥40Gy)	Higher risk if history of surgery to bone cortex	Examination – pain, swelling, deformity – and XR as clinically indicated
Hepatic fibrosis Cirrhosis (If ≥30Gy)	Higher risk if: • Chronic hepatitis or veno-occlusive disease • Alcohol use	• **Yearly** history and examination – jaundice, spider naevi, palmar erythema, xanthoamata, hepatomegaly, splenomegaly As clinically indicated: • LFTs • Viral hepatitis serology • Clotting profile
Cholelithiasis (If ≥30Gy)	Higher risk if: • Ileal conduit • Obesity • Pregnancy • Family history • Abdominal surgery • Abdominal irradiation • TPN	**Yearly** and as clinically indicated: • History - pain, excessive flatulence • Examination – RUQ tenderness • Upper abdo USS
Bowel obstruction (If ≥30Gy)	Higher risk if abdominal surgery	If clinically indicated: • History – abdominal pain, distension, vomiting, constipation • Examination – tenderness, guarding, distension • U&Es
Chronic enterocolitis Fistula Stricture (If ≥30Gy)	Higher risk if abdominal surgery	**Yearly** history – nausea, vomiting, abdo pain, diarrhoea
Colon cancer ((If ≥30Gy)	Higher risk if: • Age >50 • Obesity • High fat, low fibre diet Highest risk if: • History of ulcerative colitis, GI malignancy, adenomatous polyps, hepatoblastoma • Familial polyposis • Family history of colorectal cancer or polyps in first degree relatives	**5 yearly** colonoscopy beginning 10 years after radiation or at age 35. Begin screening earlier if at higher risk
Renal toxicity • Renal insufficiency • HPT	Higher risk if: • Bilateral Wilms tumour • One kidney • Combination with other nephrotoxic agents • Medical conditions – diabetes, HPT	• **Yearly** BP • **Yearly** U&Es, Creat, Ca^{++}, Mg^{++}, PO_4 • **Yearly** urinalysis

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SPINAL IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Thyroid nodules • Thyroid cancer • Breast cancer	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Xerostomia **Salivary gland dysfunction**	Only if neck received irradiation	• **Yearly** history and examination • **6 monthly** dental examination
Dental abnormalities • Tooth/root agenesis • Microdontia • Root thinning/shortening • Enamel dysplasia • Periodontal disease • Dental caries • Malocclusion • Temporomandibular joint dysfunction	• Higher risk if younger age at treatment, particularly <5 years, or in Gorlin's syndrome • Only if neck received irradiation	**6 monthly** dental examination
Osteoradionecrosis **(if ≥40Gy)**	Higher risk if administered bisphosphonates	• History and examination – impaired healing following dental work, jaw pain or swelling, trismus- as clinically indicated • Imaging (XR, CT and/or MRI) as clinically indicated
Thyroid nodules	Higher risk in females	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA
Thyroid cancer	Higher risk in females and >5 years after irradiation	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA • **Refer immediately** if suspicious nodule on thyroid USS

Hypothyroidism	Higher risk in females	• **Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; and examination – height, weight, hair, skin, thyroid • **Yearly** TSH, Free T4 NB. Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Hyperthyroidism (if ≥40Gy)	Higher risk with higher radiation dose	• **Yearly** history – heat intolerance, tachycardia/palpitations, weight loss, emotional lability, muscular weakness, hyperphagia; and examination – eyes, skin, thyroid, cardiac, neurological examination • **Yearly** TSH, Free T4 and if clinically indicated • Endocrine review essential if clinically indicated
Carotid artery disease (if ≥40Gy)		• **Yearly** history – memory impairment; and examination – carotid bruits, neurological exam • Baseline carotid USS 10 years post radiotherapy, and as clinically indicated
Subclavian artery disease (If ≥40Gy)		• **Yearly** examination - brachial and radial pulses; pallor upper limbs; cool skin; unequal BP • Baseline Doppler USS 10 years post radiotherapy, and as clinically indicated
Oesophageal stricture (If ≥30Gy)	Higher risk if gastroesophageal reflux or history of Candida oesophagitis	• **Yearly** history – dysphagia, reflux
Cardiac toxicity • CCF • Cardiomyopathy • Pericarditis • Pericardial fibrosis • Valvular disease • MI • Arrhythmias • IHD	Higher risk if: • Familial hypercholesterolaemia • IHD or coronary risk factors including smoking • Febrile illness • Pregnancy or untreated premature ovarian failure in women Highest risk if: • Age under 5 at treatment • Longer interval since treatment	• **Yearly** history – chest pain, SOB, exertional dyspnoea, orthopnoea, palpitations – and cardiac examination • **Yearly** fasting lipids and BGL As clinically indicated and according to risk factors: • ECG • Echocardiography • Cardiology review
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Breast cancer (If ≥20Gy)	Higher risk if family history of breast cancer and longer time since radiation (>5 years)	• **Yearly** breast examination • **Yearly** mammography/breast USS beginning 8 years after radiotherapy
Scoliosis	Highest risk with orthovoltage radiation (commonly given before 1970)	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Kyphosis	Highest risk with orthovoltage radiation (commonly given before 1970) Higher risk if patient has neurofibromatosis	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Radiation-induced fracture (If ≥40Gy)	Higher risk if history of surgery to bone cortex	Examination – pain, swelling, deformity – and XR as clinically indicated

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THORACIC IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Thyroid nodules • Thyroid cancer • Breast cancer • Colorectal cancer	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Thyroid nodules	Higher risk in females	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA
Thyroid cancer	Higher risk in females and >5 years after irradiation	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA • **Refer immediately** if suspicious nodule on thyroid USS
Hypothyroidism	Higher risk in females	• **Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; and examination – height, weight, hair, skin, **thyroid** • **Yearly** TSH, Free T4 NB. Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Hyperthyroidism **(if ≥40Gy)**	Higher risk with higher radiation dose	• **Yearly** history – heat intolerance, tachycardia/palpitations, weight loss, emotional lability, muscular weakness, hyperphagia; and examination – eyes, skin, thyroid, cardiac, neurological examination • **Yearly** TSH, Free T4 and if clinically

		indicated • Endocrine review essential if clinically indicated
Carotid artery disease (if ≥40Gy)		• **Yearly** history – memory impairment; and examination – carotid bruits, neurological exam • Baseline carotid USS 10 years post radiotherapy, and as clinically indicated
Subclavian artery disease (If ≥40Gy)		• **Yearly** examination - brachial and radial pulses; pallor upper limbs; cool skin; unequal BP • Baseline Doppler USS 10 years post radiotherapy, and as clinically indicated
Breast cancer (If ≥20Gy)	Higher risk if family history of breast cancer and longer time since radiation (>5 years)	• **Yearly** breast examination • **Yearly** mammography/breast USS beginning 8 years after radiotherapy
Breast tissue hypoplasia	Higher risk if prepubertal at time of breast radiation	**Yearly** breast examination
Pulmonary toxicity • Pulmonary fibrosis • Interstitial pneumonitis • Restrictive lung disease • COAD	Higher risk if atopic and in smokers	• **Yearly** history – cough, SOB, exertional dyspnoea, wheeze – and examination • **Yearly** CXR • PFTs as clinically indicated
Cardiac toxicity • CCF • Cardiomyopathy • Pericarditis • Pericardial fibrosis • Valvular disease • MI • Arrhythmias • IHD	Higher risk if: • Familial hypercholesterolaemia • IHD or coronary risk factors including smoking • Febrile illness • Pregnancy or untreated premature ovarian failure in women Highest risk if: • Age under 5 at treatment • Longer interval since treatment	• **Yearly** history – chest pain, SOB, exertional dyspnoea, orthopnoea, palpitations – and cardiac examination • **Yearly** fasting lipids and BGL As clinically indicated and according to risk factors: • ECG • Echocardiography • Cardiology review
Oesophageal stricture (If ≥30Gy)	Higher risk if gastroesophageal reflux or history of Candida oesophagitis	• **Yearly** history – dysphagia, reflux
Colorectal cancer ((If ≥30Gy)	Higher risk if: • Age >50 • Obesity • High fat, low fibre diet Highest risk if: • History of ulcerative colitis, GI malignancy, adenomatous polyps, hepatoblastoma • Familial polyposis • Family history of colorectal cancer or polyps in first degree relatives	**5 yearly** colonoscopy beginning 10 years after radiation or at age 35. Begin screening earlier if at higher risk
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Scoliosis	Highest risk with orthovoltage radiation (commonly given before 1970)	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Kyphosis	Highest risk with orthovoltage radiation (commonly given before 1970) Higher risk if patient has neurofibromatosis	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Radiation-induced fracture (If ≥40Gy)	Higher risk if history of surgery to bone cortex	Examination – pain, swelling, deformity – and XR as clinically indicated

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ABDOMINAL IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Breast cancer (only if >20Gy and in childhood) • Colorectal cancer • Bladder malignancy	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Cardiac toxicity • CCF • Cardiomyopathy • Pericarditis • Pericardial fibrosis • Valvular disease • MI • Arrhythmias • IHD	Higher risk if: • Familial hypercholesterolaemia • IHD or coronary risk factors including smoking • Febrile illness • Pregnancy or untreated premature ovarian failure in women Highest risk if: • Age under 5 at treatment • Longer interval since treatment	• **Yearly** history – chest pain, SOB, exertional dyspnoea, orthopnoea, palpitations – and cardiac examination • **Yearly** fasting lipids and BGL As clinically indicated and according to risk factors: • ECG • Echocardiography • Cardiology review
Breast cancer **(If ≥20Gy, and in childhood)**	Higher risk if family history of breast cancer and longer time since radiation (≥5 years)	• **Yearly** breast examination • **Yearly** mammography/breast USS beginning 8 years after radiotherapy
Functional asplenism **(If ≥40Gy)** Risk of life-threatening infection with encapsulated organisms	Higher risk with higher radiation doses to entire spleen	Enrol in Victorian Spleen Registry: phone 9076 3928 Victorian Spleen Registry registration form Victorian Spleen Registry recommendations for prevention of infection in asplenic (or hyposplenic) patients
Oesophageal stricture **(If ≥30Gy)**	Higher risk if gastroesophageal reflux or history of Candida oesophagitis	• **Yearly** history – dysphagia, reflux
Hepatic fibrosis **Cirrhosis** **(If ≥30Gy)**	Higher risk if: • Chronic hepatitis or veno-occlusive disease • Alcohol use	• **Yearly** history and examination – jaundice, spider naevi, palmar erythema, xanthoamata, hepatomegaly, splenomegaly As clinically indicated: • LFTs • Viral hepatitis serology • Clotting profile
Cholelithiasis **(If ≥30Gy)**	Higher risk if: • Ileal conduit • Obesity	**Yearly** and as clinically indicated: • History - pain, excessive flatulence • Examination – RUQ tenderness

	• Pregnancy • Family history • Abdominal surgery • Abdominal irradiation • TPN	• Upper abdo USS
Bowel obstruction **(If ≥30Gy)**	Higher risk if abdominal surgery	If clinically indicated: • History – abdominal pain, distension, vomiting, constipation • Examination – tenderness, guarding, distension • U&Es
Chronic enterocolitis **Fistula** **Stricture** **(If ≥30Gy)**	Higher risk if abdominal surgery	**Yearly** history – nausea, vomiting, abdo pain, diarrhoea
Colorectal cancer **((If ≥30Gy)**	Higher risk if: • Age >50 • Obesity • High fat, low fibre diet Highest risk if: • History of ulcerative colitis, GI malignancy, adenomatous polyps, hepatoblastoma • Familial polyposis • Family history of colorectal cancer or polyps in first degree relatives	**5 yearly** colonoscopy beginning 10 years after radiation or at age 35. Begin screening earlier if at higher risk
Renal toxicity • Renal insufficiency • HPT	Higher risk if: • Bilateral Wilms tumour • One kidney • Combination with other nephrotoxic agents • Medical conditions – diabetes, HPT	• **Yearly** BP • **Yearly** U&Es, Creat, Ca^{++}, Mg^{++}, PO_4 • **Yearly** urinalysis
Haemorrhagic cystitis **(If ≥30Gy)** (Only if radiation field extended below iliac crest)		• **Yearly** history – haematuria, urgency/frequently, urinary incontinence or retention, dysuria, nocturia, abnormal stream • **Yearly** urinalysis As clinically indicated: • MSU • Spot urine Ca:Creat • Urinary tract USS
Urinary tract toxicity **(If ≥30Gy)** • Bladder fibrosis • Dysfunctional voiding • Vesicoureteric reflux • Hydronephrosis (Only if field extended below iliac crest)		• **Yearly** history – haematuria, urgency/frequently, urinary incontinence or retention, dysuria, nocturia, abnormal stream • **Yearly** urinalysis
Bladder malignancy (Only if field extended below iliac crest)	Higher risk if: • Alcohol use • Smokers	• **Yearly** history – haematuria, urgency/frequently, urinary incontinence or retention, dysuria, nocturia, abnormal stream • **Yearly** urinalysis As clinically indicated: • MSU • Spot urine Ca:Creat • Urinary tract USS
Uterine vascular insufficiency (Only if field extended below iliac crest) • Spontaneous abortion • Neonatal death • Low birth weight infant • Foetal malposition	Higher risk in females with Wilms tumour and associated uterine abnormalities; and if prepubertal at treatment	High-risk obstetric care in pregnancy

• Premature labour		
Ovarian dysfunction (Only if field extended below iliac crest) • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk if older age at radiation, and longer time since treatment	As clinically indicated: • FSH, LH, Oestradiol • Bone density • Endocrinology referral • Reproductive endocrinology referral
Vaginal fibrosis/stenosis (Only if field extended below iliac crest)	Higher risk if chronic graft vs host disease	• **Yearly** history – dyspareunia, vulval pain, post-coital bleeding, difficulty with tampon insertion • Gynaecology referral if clinically indicated
Testicular dysfunction (Only if field extended below iliac crest) - Germ cell dysfunction (oligospermia, azoospermia, infertility)	Higher risk if chronic graft vs host disease	• Semen analysis and reproductive endocrinology referral on request
Testicular dysfunction (Only if field extended below iliac crest) - Leydig cell dysfunction (delayed/arrested puberty, hypogonadism)	Higher risk if combined cranial and testicular radiation	As clinically indicated: • History – puberty, sexual function • FSH, LH, testosterone
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Scoliosis	Highest risk with orthovoltage radiation (commonly given before 1970)	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Kyphosis	Highest risk with orthovoltage radiation (commonly given before 1970) Higher risk if patient has neurofibromatosis	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Radiation-induced fracture **(If ≥40Gy)**	Higher risk if history of surgery to bone cortex	Examination – pain, swelling, deformity – and XR as clinically indicated

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PELVIC IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies • Colorectal cancer • Bladder malignancy	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Bowel obstruction **(If ≥30Gy)**	Higher risk if abdominal surgery	If clinically indicated: • History – abdominal pain, distension, vomiting, constipation • Examination – tenderness, guarding, distension • U&Es
Chronic enterocolitis **Fistula** **Stricture** **(If ≥30Gy)**	Higher risk if abdominal surgery	**Yearly** history – nausea, vomiting, abdo pain, diarrhoea
Colorectal cancer **((If ≥30Gy)**	Higher risk if: • Age >50 • Obesity • High fat, low fibre diet Highest risk if: • History of ulcerative colitis, GI malignancy, adenomatous polyps, hepatoblastoma • Familial polyposis • Family history of colorectal cancer or polyps in first degree relatives	**5 yearly** colonoscopy beginning 10 years after radiation or at age 35. Begin screening earlier if at higher risk
Renal toxicity • Renal insufficiency • HPT	Higher risk if: • Bilateral Wilms tumour • One kidney • Combination with other nephrotoxic agents • Medical conditions – diabetes, HPT	• **Yearly** BP • **Yearly** U&Es, Creat, Ca^{++}, Mg^{++}, PO_4 • **Yearly** urinalysis
Haemorrhagic cystitis **(If ≥30Gy)** (Only if radiation field extended below iliac crest)		• **Yearly** history – haematuria, urgency/frequently, urinary incontinence or retention, dysuria, nocturia, abnormal stream • **Yearly** urinalysis As clinically indicated: • MSU • Spot urine Ca:Creat • Urinary tract USS

Urinary tract toxicity **(If ≥30Gy)** • Bladder fibrosis • Dysfunctional voiding • Vesicoureteric reflux • Hydronephrosis (Only if field extended below iliac crest)		• **Yearly** history – haematuria, urgency/frequently, urinary incontinence or retention, dysuria, nocturia, abnormal stream • **Yearly** urinalysis
Bladder malignancy (Only if field extended below iliac crest)	Higher risk if: • Alcohol use • Smokers	• **Yearly** history – haematuria, urgency/frequently, urinary incontinence or retention, dysuria, nocturia, abnormal stream • **Yearly** urinalysis As clinically indicated: • MSU • Spot urine Ca:Creat • Urinary tract USS
Uterine vascular insufficiency (Only if field extended below iliac crest) • Spontaneous abortion • Neonatal death • Low birth weight infant • Foetal malposition • Premature labour	Higher risk in females with Wilms tumour and associated uterine abnormalities; and if prepubertal at treatment	High-risk obstetric care in pregnancy
Ovarian dysfunction (Only if field extended below iliac crest) • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk if older age at radiation, and longer time since treatment	As clinically indicated: • FSH, LH, Oestradiol • Bone density • Endocrinology referral • Reproductive endocrinology referral
Vaginal fibrosis/stenosis (Only if field extended below iliac crest)	Higher risk if chronic graft vs host disease	• **Yearly** history – dyspareunia, vulval pain, post-coital bleeding, difficulty with tampon insertion • Gynaecology referral if clinically indicated
Testicular dysfunction (Only if field extended below iliac crest) - Germ cell dysfunction (oligospermia, azoospermia, infertility)	Higher risk if chronic graft vs host disease	• Semen analysis and reproductive endocrinology referral on request
Testicular dysfunction (Only if field extended below iliac crest) - Leydig cell dysfunction (delayed/arrested puberty, hypogonadism)	Higher risk if combined cranial and testicular radiation	As clinically indicated: • History – puberty, sexual function • FSH, LH, testosterone
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Scoliosis	Highest risk with orthovoltage radiation (commonly given before 1970)	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Radiation-induced fracture **(If ≥40Gy)**	Higher risk if history of surgery to bone cortex	Examination – pain, swelling, deformity – and XR as clinically indicated

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MUSCULOSKELETAL IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Bone malignancies	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Bone malignancies	Higher risk if cancer predisposing genetic mutation, or adolescent at treatment	• **Yearly** history of bony pain and examination (palpation) of bones in irradiated field • CT or MRI scan of the irradiated area **3-5 yearly**
Skin changes • Fibrosis • Telangectasiae • Alopecia • Altered skin pigmentation		**Yearly** examination of skin in irradiated fields
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field • Dose >20 Gy	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones
Scoliosis	Highest risk with orthovoltage radiation (commonly given before 1970)	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Kyphosis	Highest risk with orthovoltage radiation (commonly given before 1970) Higher risk if patient has neurofibromatosis	As clinically indicated: • Examination – spine • Spine XR • Orthopaedic referral
Radiation-induced fracture (If ≥40Gy)	Higher risk if history of surgery to bone cortex	Examination – pain, swelling, deformity – and XR as clinically indicated

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TOTAL BODY IRRADIATION

Potential late effects	Considerations	Follow up recommendations
Secondary neoplasms – benign or malignant Occurring in or near radiation field • Dysplastic naevi and skin cancer • Brain tumour – benign or malignant • Thyroid nodules • Thyroid cancer • Breast cancer • Colorectal cancer	Higher risk if cancer predisposing genetic mutation, or bilateral or familial retinoblastoma (increased risk of developing second malignancies)	• **Yearly** examination of skin and soft tissues in irradiated field(s) • See relevant sections below for specific screening recommendations
Dysplastic naevi **Skin cancer** • BCC • SCC • Melanoma	Higher risk if sun or tanning salon exposure, or Gorlin's syndrome (BCCs)	**Yearly** history of skin lesions, changing moles; and examination of skin in irradiated fields
Brain tumour – benign or malignant	Higher risk in patients who have neurofibromatosis	• **Yearly** history – headaches; vomiting; cognitive, motor or sensory deficits; seizures or other neurological symptoms; and neurological examination • MRI: yearly initially until stable, then every 2 years and as clinically indicated • For patients with neurofibromatosis, every 2 years commencing 2 years after radiotherapy
Neurocognitive deficits • Functional deficits in planning and organization, sustained attention, memory, processing speed and visual-motor integration • Learning deficits (maths and reading) • Lowered IQ • Behavioural changes	Highest risk if: • Age< 3 years at time of treatment • Females • Premorbid or family history of learning or attention problems	• **Yearly** education and employment • Neuropsychological testing if clinically indicated
Clinical leukoencephalopathy • Spasticity • Ataxia • Dysarthria • Dysphagia • Hemiparesis • Seizures	Acute side effect of treatment which may have long-term sequelae	• **Yearly** history of cognitive, motor and/or sensory deficits; seizures; other neurological symptoms • **Yearly** neurological examination • Brain MRI, and CT with MR angiography as clinically indicated • Neurology referral and follow-up as clinically indicated
Metabolic syndrome • Central obesity • HPT • Dyslipidaemia • Abnormal glucose metabolism	Higher risk if: • Growth hormone deficiency • Hypogonadism • Surgery in suprasellar region • Obese	• **Yearly** BMI and BP • **2 yearly** fasting blood glucose and lipids (HDL, LDL, TGs) or as clinically indicated • Consider Endocrine review
Growth hormone deficiency	Higher risk if surgery/tumour in hypothalamic area	• **Yearly** nutritional assessment and BMI • TFTs as clinically indicated • Bone mineral density as clinically indicated in those with GH deficiency • Endocrine mandatory if suspected
Cataracts		• **Yearly** history – visual changes (decreased acuity, halos, diplopia) and examination – visual acuity, fundoscopy • **Yearly** Ophthalmology review for patients with ocular tumours and those

		who received TBI or >30Gy cranial/orbital/eye radiation; and every 3 years for patients without ocular tumours who received <30Gy
Dental abnormalities • Tooth/root agenesis • Microdontia • Root thinning/shortening • Enamel dysplasia • Periodontal disease • Dental caries • Malocclusion • Temporomandibular joint dysfunction	Higher risk if younger age at treatment, particularly <5 years, or in Gorlin's syndrome	**6 monthly** dental examination
Thyroid nodules	Higher risk in females	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA
Thyroid cancer	Higher risk in females and >5 years after irradiation	• **Yearly** thyroid examination • Thyroid USS every 2 years (if NAD), commencing 2 years after radiation • If more than one nodule, or nodule <5mm, **yearly** thyroid USS • If nodule >5mm **refer** for endocrine/surgical review and for consideration of FNA • **Refer immediately** if suspicious nodule on thyroid USS
Hypothyroidism	Higher risk in females	• **Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; and examination – height, weight, hair, skin, thyroid • **Yearly** TSH, Free T4 NB. Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.
Breast cancer **(If TBI combined with other breast irradiation totalling ≥20Gy)**	Higher risk if family history of breast cancer and longer time since radiation (≥5 years)	• **Yearly** breast examination • **Yearly** mammography/breast USS beginning 8 years after radiotherapy
Breast tissue hypoplasia	Higher risk if prepubertal at time of breast radiation	**Yearly** breast examination
Pulmonary toxicity • Pulmonary fibrosis • Interstitial pneumonitis • Restrictive lung disease • COAD	Higher risk if atopic and in smokers	• **Yearly** history – cough, SOB, exertional dyspnoea, wheeze – and examination • **Yearly** CXR • PFTs as clinically indicated
Cardiac toxicity • CCF • Cardiomyopathy • Pericarditis • Pericardial fibrosis • Valvular disease • MI • Arrhythmias • IHD	Higher risk if: • Familial hypercholesterolaemia • IHD or coronary risk factors including smoking • Febrile illness • Pregnancy or untreated premature ovarian failure in women Highest risk if: • Age under 5 at treatment	• **Yearly** history – chest pain, SOB, exertional dyspnoea, orthopnoea, palpitations – and cardiac examination • **Yearly** fasting lipids and BGL As clinically indicated and according to risk factors: • ECG • Echocardiography • Cardiology review

	• Longer interval since treatment	
Colorectal cancer **(If TBI combined with abdominal irradiation totalling ≥30Gy)**	Higher risk if: • Age ≥50 • Obesity • High fat, low fibre diet Highest risk if: • History of ulcerative colitis, GI malignancy, adenomatous polyps, hepatoblastoma • Familial polyposis • Family history of colorectal cancer or polyps in first degree relatives	**5 yearly** colonoscopy beginning 10 years after radiation or at age 35. Begin screening earlier if at higher risk
Renal toxicity • Renal insufficiency • HPT	Higher risk if: • Bilateral Wilms tumour • One kidney • Combination with other nephrotoxic agents • Medical conditions – diabetes, HPT	• **Yearly** BP • **Yearly** U&Es, Creat, Ca^{++}, Mg^{++}, PO_4 • **Yearly** urinalysis
Uterine vascular insufficiency • Spontaneous abortion • Neonatal death • Low birth weight infant • Foetal malposition • Premature labour	Higher risk in females with Wilms tumour and associated uterine abnormalities; and if prepubertal at treatment	High-risk obstetric care in pregnancy
Ovarian dysfunction • Delayed/arrested puberty • Premature menopause • Infertility	Higher risk if older age at radiation, and longer time since treatment	As clinically indicated: • FSH, LH, Oestradiol • Bone density • Endocrinology referral • Reproductive endocrinology referral
Testicular dysfunction - Germ cell dysfunction (oligospermia, azoospermia, infertility)	Higher risk if chronic graft vs host disease	Semen analysis and reproductive endocrinology referral on request
Testicular dysfunction - Leydig cell dysfunction (delayed/arrested puberty, hypogonadism)		As clinically indicated: • History – puberty, sexual function • FSH, LH, testosterone
Musculoskeletal growth problems • Hypoplasia • Fibrosis • Reduced or uneven growth • Reduced trunk height • Limb length discrepancy	Higher risk if: • Prepubertal at treatment • Orthovoltage radiation (commonly given prior to 1970) • Epiphysis in treatment field • Cumulative dose >20 Gy	• Examination – ht, wt, sitting height, limb lengths as clinically indicated • Orthopaedic or Plastic surgery referral if clinically indicated Counsel regarding increased risk of fractures in weight-bearing irradiated bones

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AUTOLOGOUS STEM CELL TRANSPLANT

Potential late effects	Considerations	Follow up recommendations
Acute myeloid leukaemia Myelodysplasia		**Yearly** history – fatigue, bleeding, easy bruising- skin examination – pallor, petichiae, purpura – and FBE and film until 10 years post transplant
Solid tumours Skin cancer	Higher risk if Hepatitis C, chronic graft vs. host disease, or HPV in females	**Yearly** screening for benign or malignant neoplasms, particularly cervical cancer and skin cancer
Lymphoma	Higher risk if chronic graft vs. host disease	**Yearly** examination for lymphadenopathy and splenomegaly
Hepatic toxicity ▪ Chronic hepatitis ▪ Cirrhosis ▪ Iron overload	Higher risk if: ▪ History of multiple transfusions ▪ Liver irradiation ▪ Medical conditions – chronic GVHD, viral hepatitis, veno-occlusive disease ▪ Alcohol use ▪ Chronic Hepatitis C	LFTs, iron studies, clotting profile (if abnormal LFTs) and hepatitis serology as clinically indicated
Avascular necrosis	Higher risk if prolonged corticosteroid therapy or chronic graft vs. host disease	**Yearly** history – joint pain, swelling, immobility, reduced ROM – and musculoskeletal examination
Reduced bone mineral density Osteopaenia Osteoporosis	Higher risk if: ▪ Lower weight and BMI ▪ Inadequate Ca and Vitamin D ▪ Lack of weight bearing exercise ▪ Smoking ▪ Alcohol ▪ Carbonated beverages Highest risk if older age at treatment or prolonged corticosteroid therapy	Ca^{++} and Vitamin D levels, and bone density testing as clinically indicated

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ALLOGENEIC STEM CELL TRANSPLANT

Potential late effects	Considerations	Follow up recommendations
Skin cancer	Higher risk if chronic graft vs. host disease, radiotherapy or topical immunosuppression	**Yearly** skin examination
Solid tumours including: • Oral cancers • Thyroid cancer • Cervical dysplasia/cancer • Meningioma • Breast cancer • Testicular cancer • Bladder cancer	Higher risk if: • Hepatitis C ▪ Chronic graft vs. host disease ▪ HPV in females ▪ Radiotherapy	**Yearly** screening for benign or malignant neoplasms: ▪ Mammography ▪ Urine cytology ▪ PAP smears yearly ▪ Skin examination ▪ DRE and PSA ▪ FOB (>40 years) and colonoscopic screening (baseline at 50 years, then as indicated)
Lymphoma	Higher risk if chronic graft vs. host disease	Yearly examination for lymphadenopathy and splenomegaly
Hepatic toxicity ▪ Chronic hepatitis ▪ Cirrhosis ▪ Iron overload	Higher risk if: ▪ History of multiple transfusions ▪ Liver irradiation ▪ Medical conditions – chronic graft vs. host disease, viral hepatitis, veno-occlusive disease ▪ Alcohol use ▪ Chronic Hepatitis C	LFTs, iron studies, clotting profile (if abnormal LFTs) and hepatitis serology as clinically indicated
Avascular necrosis	Higher risk if prolonged corticosteroid therapy or chronic graft vs. host disease	**Yearly** history – joint pain, swelling, immobility, reduced ROM – and musculoskeletal examination
Reduced bone mineral density **Osteopaenia** **Osteoporosis**	Higher risk if: ▪ Lower weight and BMI ▪ Inadequate Ca and Vitamin D ▪ Lack of weight bearing exercise ▪ Smoking ▪ Alcohol ▪ Carbonated beverages ▪ Malnutrition ▪ Immobility Highest risk if older age at treatment or prolonged corticosteroid therapy	Ca^{++} and Vitamin D levels, and bone density testing as clinically indicated
Thyroid nodules		• **Yearly** thyroid examination • USS and FNA 1-2 yearly and as clinically indicated. **Refer for Endocrine review if nodules > 5mm**
Thyroid cancer		• **Yearly** thyroid examination • Thyroid USS every **2 years**; **yearly** if >1 nodule and <5mm **Refer for Endocrine review if nodules > 5mm**
Hypothyroidism	Advise at-risk women of childbearing age to have thyroid levels checked prior to attempting pregnancy and throughout pregnancy.	**Yearly** history – fatigue, weight gain, cold intolerance, constipation, dry hair and skin, depressed mood; examination – height, weight, hair, skin, thyroid; and TSH, T3 and free T4
Impaired fertility • Testicular dysfunction		Hormone levels, semen analysis, Endocrine and Reproductive biology review as clinically indicated
Impaired fertility • Ovarian dysfunction		Hormone levels, Gynaecology and Reproductive biology review as clinically indicated

Sexual dysfunction **Males:** • Erectile dysfunction • Low libido • Anorgasmia • Peyronie's disease **Females:** • Genital tract GVHD • Vaginal dryness • Vaginismus • Anorgasmia • Low libido • Vaginal fibrosis / stenosis	Higher risk if: • Premature menopause • Previous pelvic radiation • Chronic graft vs. host disease • Previous history of sexual dysfunction	Full sexual health assessment and hormone levels as clinically indicated
Oral considerations: • Dental caries • Oral cancers • Xerostomia • Fungal infections • Viral infections	Increased risk if have also had radiotherapy	**Yearly** oral examination and dental review
Infections ▪ Herpes simplex ▪ Herpes zoster ▪ CMV ▪ Encapsulated organisms		**Yearly** Influenza vaccine
Pulmonary toxicity • Pulmonary fibrosis • Interstitial pneumonitis • Restrictive lung disease • COAD	Higher risk if atopic or smoking	**Yearly** history – cough, SOB, exertional dyspnoea, wheeze – and examination
Cardiac toxicity • CCF • Cardiomyopathy • Pericarditis • Pericardial fibrosis • Valvular disease • MI • Arrhythmias • IHD	Higher risk if: • Familial hypercholesterolaemia • IHD or coronary risk factors including smoking • Pregnancy or untreated premature ovarian failure in women	▪ **Yearly** history – chest pain, SOB, exertional dyspnoea, orthopnoea, palpitations – and cardiac examination ▪ **Yearly** fasting lipids and BGL
Neurocognitive deficits • Functional deficits in planning and organization, sustained attention, memory, processing speed and visual-motor integration • Learning deficits (maths and reading) • Lowered IQ • Behavioural changes		**Yearly** review of education and employment. Refer for neurocognitive testing if indicated.
Metabolic syndrome • Central obesity • HPT • Dyslipidaemia • Abnormal glucose metabolism		• **Yearly** BMI, waist-to-hip ratio and BP • **Yearly** fasting blood glucose and lipids
Renal toxicity • Renal insufficiency • HPT	Higher risk if one kidney or concomitant medical conditions – diabetes, HPT	**Yearly** BP, U&Es, Creatinine, Ca^{++}, Mg^{++}, PO_4 and urinalysis

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CHRONIC GRAFT vs. HOST DISEASE

Potential late effects	Considerations	Follow up recommendations
Cutaneous / sclerodermatous GVHD ▪ Permanent alopecia ▪ Nail dysplasia ▪ Vitiligo ▪ Scleroderma ▪ SCC skin ▪ Musculoskeletal contractures/stiffness		**Yearly** examination of hair, nails and skin Dermatology review as clinically indicated
Ocular GVHD ▪ Keratoconjunctivitis sicca ▪ Sterile conjunctivitis ▪ Corneal ulceration	Consider preservative-free lubricating eye drops	**Yearly** history and examination – dry eyes Ophthalmology review as clinically indicated
Oral effects ▪ Xerostomia ▪ Salivary gland dysfunction ▪ Dental caries ▪ Periodontal disease	Higher risk if have also had radiotherapy	▪ **Yearly** history and oral examination ▪ **6 monthly** dental check up and cleaning ▪ Consider use of artificial saliva
Pulmonary toxicity ▪ Bronchiolitis obliterans ▪ Chronic bronchitis ▪ Bronchiectasis		**Yearly** history – cough, SOB, wheeze – and respiratory examination
Immunological complications ▪ Secretory IgA deficiency ▪ Hypogammaglobulinaemia ▪ Decreased B cells ▪ T cell dysfunction ▪ Chronic infections (eg conjunctivitis, sinusitis, bronchitis)		**Yearly** history – chronic conjunctivitis, sinusitis or bronchitis; recurrent or unusual infections; sepsis – and examination – eyes, sinuses, respiratory system
Oesophageal stricture	• Higher risk if: • Gastroesophageal reflux • History of Candida oesophagitis	**Yearly** history – dysphagia, heartburn
Sexual dysfunction **Males:** • Erectile dysfunction • Low libido • Anorgasmia • Peyronie's disease **Females:** • Genital tract GVHD • Vaginal dryness • Vaginismus • Anorgasmia • Low libido • Vaginal fibrosis / stenosis		Hormone levels and full sexual health assessment as clinically indicated
Functional asplenism		Enrol in Victorian Spleen Registry: phone 9076 3928 Victorian Spleen Registry registration form Victorian Spleen Registry recommendations for prevention of infection in asplenic (or hyposplenic) patients
Hepatic GVHD		Monitor LFTs and assess hepatotoxic medication

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SURGERY
AMPUTATION

Potential late effects	Considerations	Follow up recommendations
▪ Functional and activity limitations ▪ Impaired cosmesis ▪ Integrity problems in residual limb ▪ Phantom pain ▪ Neuropathic and/or musculoskeletal pain ▪ Increased energy expenditure ▪ Impaired quality of life and functional status ▪ Psychological maladjustment	Site of amputation Coexisting medical conditions: ▪ Obesity ▪ Diabetes ▪ Poor residual limb healing	▪ Yearly history – phantom pain, functional and activity limitations ▪ Yearly examination for integrity of residual limb ▪ Yearly prosthetic evaluation ▪ Consider physiotherapy referral if changing physical status eg weight gain, new prosthesis ▪ Consider OT referral if functional limitations

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CENTRAL VENOUS CATHETER

Potential late effects	Considerations	Follow up recommendations
▪ Thrombosis ▪ Vascular insufficiency ▪ Infection of retained cuff or line tract		Yearly examination for tenderness or swelling at previous CVC site or venous stasis

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CYSTECTOMY

Potential late effects	Considerations	Follow up recommendations
▪ Chronic UTI ▪ Renal dysfunction ▪ Vesicoureteric reflux ▪ Hydronephrosis ▪ Reservoir calculi ▪ Spontaneous neobladder perforation ▪ Vitamin B12/folate/ carotene deficiency (if ileal enterocystoplasty)		▪ **Yearly** Urology review, and as clinically indicated ▪ **Yearly** Vitamin B12 level commencing 5 years after cystectomy and ileal enterocystoplasty

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ENUCLEATION

Potential late effects	Considerations	Follow up recommendations
▪ Impaired cosmesis ▪ Poor prosthetic fit ▪ Orbital hypoplasia (if childhood enucleation)	At higher risk if younger age at enucleation and/or also received radiation	**Yearly** ophthalmology review

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HYSTERECTOMY

Potential late effects	Considerations	Follow up recommendations
▪ Pelvic floor dysfunction ▪ Urinary incontinence ▪ Sexual dysfunction		**Yearly** history of abdominal pain, urinary leakage, dyspareunia and psychosocial assessment

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LAPAROTOMY

Potential late effects	Considerations	Follow up recommendations
▪ Adhesions ▪ Bowel obstruction	Higher risk of complications if combined with radiation	History and examination for symptoms and signs of adhesions/bowel obstruction if clinically indicated

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LIMB SPARING PROCEDURE

Potential late effects	Considerations	Follow up recommendations
▪ Functional and activity complications ▪ Contractures ▪ Chronic infection ▪ Chronic pain ▪ Discrepancy in limb length ▪ Musculoskeletal pain ▪ Increased energy expenditure ▪ Fibrosis ▪ Prosthetic malfunction	Higher risk of complications if: ▪ Obesity ▪ High level of physical activity (associated with loosening of prosthesis) ▪ Low level of physical activity (associated with contractures and functional limitations)	▪ Yearly history (functional and activity limitations) and examination (residual limb integrity) ▪ Yearly XR affected limb and Orthopaedic review ▪ Consider physiotherapy review if changes in functional status ▪ Prophylactic antibiotics may be indicated prior to dental or invasive procedures

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NEPHRECTOMY

Potential late effects	Considerations	Follow up recommendations
Renal toxicity: ▪ Proteinuria ▪ Hyperfiltration ▪ Renal insufficiency ▪ Hypertension	Higher risk of complications if: ▪ Hypospadias ▪ Cryptorchidism ▪ Bilateral Wilms tumours ▪ Treatment factors – combination with other nephrotoxic chemotherapy or radiation impacting the kidneys	▪ Yearly examination – BP, testicular examination to exclude hydrocele ▪ Yearly U&Es, Creat, Ca, Mg, PO^4, and urinalysis ▪ Renal referral if HPT, proteinuria or progressive renal insufficiency ▪ Advise regarding contact sports, bicycle safety, proper use of seatbelts ▪ Use NSAIDs with caution

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NEUROSURGERY - BRAIN

Potential late effects	Considerations	Follow up recommendations
Neurocognitive effects ▪ Functional deficits in: ➢ Planning and organisation ➢ Memory ➢ Sustained attention ➢ Processing speed ➢ Visual-motor integration ▪ Learning deficits (especially maths and reading comprehension) ▪ Diminished IQ ▪ Behavioural changes	Higher risk if: ▪ Younger age at treatment ▪ Primary CNS tumour ▪ Predisposing family history of learning difficulties or attention deficits ▪ Higher radiation doses	▪ **Yearly** review of Education and employment progress ▪ Consider formal neuropsychological assessment
Motor and/or sensory deficits ▪ Paralysis ▪ Movement disorders ▪ Ataxia ▪ Eye problems (ocular nerve palsy, gaze paresis, nystagmus, papilloedema, optic atrophy)		Neurology and Ophthalmology referrals if clinically indicated
Seizures		**6 monthly** Neurology review
Hydrocephalus Shunt malfunction		**Yearly** Neurosurgical review

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NEUROSURGERY – SPINAL CORD

Potential late effects	Considerations	Follow up recommendations
Neurogenic bladder Urinary incontinence	Risk is higher if tumour adjacent to or compressing spinal cord or cauda equina; especially if injury above the level of the sacrum	**Yearly** review of urinary symptoms (haematuria, urinary symptoms including retention or incontinence) and Urological review if clinically indicated
Neurogenic bowel Faecal incontinence		**Yearly** review of bowel symptoms (chronic constipation, faecal soiling) and rectal examination and as clinically indicated
Male sexual dysfunction	Risk is higher if tumour adjacent to or compressing spinal cord or cauda equina; especially if injury above the level of the sacrum; and if co-existing hypogonadism	**Yearly** review of sexual function and Urology review if indicated
Female sexual dysfunction		**Yearly** review of sexual function (dyspareunia, altered or diminished sensation)

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OOPHOROPEXY

Potential late effects	Considerations	Follow up recommendations
▪ Inability to conceive despite normal ovarian function ▪ Dyspareunia ▪ Symptomatic ovarian cysts ▪ Bowel obstruction ▪ Pelvic adhesions	Higher risk if combined with radiotherapy to the ovaries	**Yearly** review of symptoms (abdominal or pelvic pain, dyspareunia, inability to conceive despite normal ovarian function) and Gynaecology referral if indicated

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OOPHORECTOMY

Potential late effects	Considerations	Follow up recommendations
Unilateral ▪ Premature menopause	Higher risk in smokers	▪ Yearly review of symptoms (puberty, menstrual history, pregnancies, sexual function) ▪ Yearly FSH, LH
Bilateral ▪ Hypogonadism ▪ Infertility		▪ Endocrinology, Gynaecology review as clinically indicated ▪ Bone density studies as clinically indicated

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ORCHIDECTOMY

Potential late effects	Considerations	Follow up recommendations
Hypogonadism Infertility	Higher risk if combined with radiation or alkylating agent chemotherapy.	FSH, LH, testosterone and semen analysis if unilateral orchidectomy on request.

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PELVIC SURGERY/CYSTECTOMY

Potential late effects	Considerations	Follow up recommendations
Urinary incontinence Urinary tract obstruction	Higher risk if: ▪ Tumour adjacent to or compressing on spinal cord or cauda equina ▪ Retroperitoneal node dissection ▪ Extensive pelvic dissection ▪ Radiation to the bladder, pelvis and/or lumbosacral spine	**Yearly** review of urinary symptoms (haematuria, urgency/frequency, incontinence, dysuria) and Urological review if indicated
Faecal incontinence	Higher risk if: ▪ Tumour adjacent to or compressing on spinal cord or cauda equina Radiation to the bladder, pelvis and/or lumbosacral spine	**Yearly** review of bowel symptoms (chronic constipation, faecal soiling) and rectal examination
Male sexual dysfunction ▪ Retrograde ejaculation ▪ Failure of ejaculation ▪ Erectile dysfunction	Higher risk if: ▪ Retroperitoneal tumour of node dissection, particularly if extensive; cystectomy; radical prostatectomy ▪ Tumour adjacent to spine or pre-sacrum ▪ Radiation to bladder, pelvis, spine or penile bulb ▪ Hypogonadism	▪ **Yearly** review of symptoms: sexual function, quality of ejaculate (frothy white urine on first voiding after intercourse suggests retrograde ejaculation) ▪ Urology referral if clinically indicated
Female sexual dysfunction	Higher risk if: ▪ Chronic graft vs host disease ▪ Hypogonadism ▪ Tumour adjacent to spine Radiation to bladder, pelvis or spine	**Yearly** review of symptoms (dyspareunia, altered or diminished sensation)
Hydrocele	Higher risk if retroperitoneal node dissection	**Yearly** examination of the testes

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PULMONARY SURGERY

Potential late effects	Considerations	Follow up recommendations
Impaired lung function	At higher risk if: ▪ Combined with pulmonary toxic therapy – bleomycin, busulfan, carmustine (BCNU), Lomustine (CCNU) ▪ Atopy ▪ Smoker Highest risk if combined with chest radiation or total body irradiation	▪ **Yearly** review of respiratory symptoms (cough, SOB, wheeze) and clinical examination ▪ CXR and lung function testing if clinically indicated ▪ Consider Influenza and Pneumococcal vaccination

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SPLENECTOMY

Potential late effects	Follow up recommendations
Asplenism Risk of life-threatening infection with encapsulated organisms	Enrol in Victorian Spleen Registry: phone 9076 3928 (if not already enrolled) Victorian Spleen Registry registration form Victorian Spleen Registry recommendations for prevention of infection in asplenic (or hyposplenic) patients

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THYROIDECTOMY

Potential late effects	Considerations	Follow up recommendations
Hypothyroidism		▪ **Yearly** review for symptoms of hypothyroidism (fatigue, weight gain, cold intolerance, constipation, dry skin, brittle hair, depressed mood) and examination (height, weight, hair and skin, thyroid) ▪ **Yearly** TFTs ▪ Endocrine review if indicated

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RADIOACTIVE IODINE THYROID ABLATION

Potential late effects	Considerations	Follow up recommendations
Lacrimal duct atrophy		▪ **Yearly** review for excessive tearing
Hypothyroidism		▪ **Yearly** review for symptoms of hypothyroidism (fatigue, weight gain, cold intolerance, constipation, dry skin, brittle hair, depressed mood) and examination (height, weight, hair and skin, thyroid) ▪ **Yearly** TFTs ▪ Endocrine review if indicated

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SYSTEMIC MIBG (iodine-131-meta-iodobenzylguanidine)

Potential late effects	Considerations	Follow up recommendations
Hypothyroidism	MIBG used for diagnostic purposes (eg MIBG scanning) does **not** put patients at risk of hypothyroidism	▪ **Yearly** review for symptoms of hypothyroidism (fatigue, weight gain, cold intolerance, constipation, dry skin, brittle hair, depressed mood) and examination (height, weight, hair and skin, thyroid) ▪ **Yearly** TFTs ▪ Endocrine review if indicated

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