

**Technology and Equipment Committee**

**Linear Accelerators**

**Updated Material Presented by**

**Novant Health, Inc.**

**Radiation Oncology  
(Include in the Radiation Oncology Text in SMFP)**

Today's radiation oncology department requires a standard treatment delivery platform to delivery 2 D, 3 D conformal external beam radiation therapy and intensity modulated radiation therapy which make up the majority of the treatment techniques. The standard treatment platform may be expanded to provide more specialized treatment techniques. The following table outlines the required linear accelerator platform and lists additional features that can be added to the standard platform for linear accelerators.

<b>TODAY'S STANDARD LINEAR ACCELERATOR PLATFORM</b>	
<b>X</b>	Dual Photon Energies
<b>X</b>	Multiple Electron Energies
<b>X</b>	Multi-leaf collimator
<b>X</b>	Electronic portal imaging device (meV)
<b>X</b>	Record and Verify system
<b>LINEAR ACCELERATOR ADD-ONS (Upgrades)</b>	
	On Board Imaging (keV)
	Respiratory Gating
	Stereotactic Radiosurgery
	Volumetric Modulated Adaptive Therapy (VMAT)
<b>X = MUST HAVE</b>	

It must be noted that specialized linear accelerators have specific and limited treatment delivery techniques, I.E. Stereotactic Radiosurgery = Cyberknife and Novalis equipment. The American College of Radiology and the American College of Radiation Oncology both have established practice guidelines/standards that outline industry accepted processes. The following table lists the variety of linear accelerators used to delivery standard and more specialized treatment techniques, including expected time per treatment.

Equipment	Method of Radiation Therapy Delivery	Components	Component Function	Use of Equip or Component for Diagnosis, Monitoring, Treatment	Equipment Examples	Time Interval for Treatment Delivery or Imaging
<b>Linear Accelerator</b>	A. 2-Dimensional & 3-Dimensional Conformal External Beam  B. Intensity Modulated Radiation Therapy (IMRT) techniques	<b>STANDARD PLATFORM</b>	1. Treatment 2. Treatment 3. Treatment 4. Treatment and Monitoring	1. Treatment 2. Treatment 3. Treatment 4. Treatment and Monitoring	1. - 4. Varian Clinac eX, Clinac iX, Trilogy Elekta Synergy Siemens	15 minutes
		5. Record and Verify system	5. Monitoring	5. Monitoring	5. Impac and Aria	20 minutes
		<b>UPGRADES</b>	6. Monitoring and Treatment	6. Monitoring and Treatment	6. Add-on	6a. 20 minutes 6b. 30 minutes
		6. On Board Imaging (keV) a. Stereoscopic X-ray Guidance b. Cone Beam CT	7. Monitoring and Treatment	7. Monitoring and Treatment	7. Add-on	7. 15 minutes
		7. Respiratory Gating	8. Treatment: for cranial and body sites	8. Treatment: for cranial and body sites	8. Varian Tribology iX (SRS); Novalis (SRS); Elekta Axesse	8. 90-120 min
		8. Stereotactic Radiosurgery	9. Treatment	9. Treatment	9. Varian Rapid Arc (VMAT); Elekta VMAT Adaptive	9. 30 min.
		9. Volumetric Modulated Adaptive Therapy (VMAT)	More specific & limited use radiation therapy treatments for cranial and body sites	More specific & limited use radiation therapy treatments for cranial and body sites	1. Accuray Cyberknife Robotic Radiosurgery	1. 90-120 min.
		1. Stereotactic Radiosurgery	More specific & limited use radiation therapy treatments for cranial and body sites	More specific & limited use radiation therapy treatments for cranial and body sites	TomoTherapy Hi-Art	1. 30 min. 2. 60 min.
		1. IMRT 2. Stereotactic Radiosurgery	More specific & limited use radiation therapy treatments for cranial only	Treatment	Elekta (Leksell)	1. TBD
1. Stereotactic Radiosurgery						
<b>Cyberknife</b>						
<b>TomoTherapy</b>						
<b>Gamma Knife*</b>						

\*Gamma Knife is included in this table for comparison purposes only, the need for Gamma Knife Technology is discussed in the previous Section of the SMFP Technology and Equipment. Chapter. File: *LinacDiscussionGroup Linear Accelerator Platform (2)FINAL.04.15.08.doc*

**Methodology for Determining Need (page 104 in current SMFP)**

(Insert at the beginning of this section)

Based upon the American College of Radiology Clinical Blue Book, one ESTV procedure, on average, takes 15 minutes or 4 ESTV procedures per hour, on average. Thus, using a 40 hour week, 52 weeks a year the annual capacity of a linear accelerator is defined as 8,320 ESTVs ( $= 4/\text{hour} \times 40 \text{ hours/week} \times 52 \text{ weeks/year}$ ). The planning target of 6,750 ESTVs is approximately 80% of capacity.

*File: LinacDiscussionGroup Linear Accelerator Platform (2)FINAL.04.15.08.doc*

CPT	Description	Number of Procedures	ESTVs/ Procedures Under ACR	Total ACR ESTVs
		A	B	C = A x B
	<b>Simple Treatment Delivery:</b>			
77401	Radiation treatment delivery		1	
77402	Radiation treatment delivery (<5 MeV)		1	
77403	Radiation treatment delivery (6-10 MeV)		1	
77404	Radiation treatment delivery (11-19 MeV)		1	
77406	Radiation treatment delivery (>20 MeV)		1	
	<b>Intermediate Treatment Delivery:</b>			
77407	Radiation treatment delivery (<5 MeV)		1	
77408	Radiation treatment delivery (6-10 MeV)		1	
77409	Radiation treatment delivery (11-19 MeV)		1	
77411	Radiation treatment delivery (>'20 MeV)		1	
	<b>Complex Treatment Delivery:</b>			
77412	Radiation treatment delivery (<5 MeV)		1	
77413	Radiation treatment delivery (6-10 MeV)		1	
77414	Radiation treatment delivery (11-19 MeV)		1	
77416	Radiation treatment delivery (>= 20 MeV)		1	
	<b>Sub-Total</b>			
<i>For the increased time required for special techniques, ESTV values are indicated below - 1.00 ESTV = 15 minutes</i>				
77417	Additional field check radiographs (port films)		0.5	
77421	Stereoscopic X-ray Guidance		1	
77014	Computed tomography guidance for placement of radiation fields (Cone-Beam CT)		2	
77418	Intensity modulated radiation treatment (IMRT) delivery		1.25	
77371	Stereotactic radiosurgery treatment delivery. Gamma Knife, 1 fraction		3	
77372	Stereotactic radiosurgery treatment delivery.			
(G0173)	Linear Accelerator, 1 fraction		7	
77373	Stereotactic radiosurgery treatment mgmt. Linear Accelerator, entire course not to exceed 5 fractions		6.00 without imaging included	
(G0339)	(Image-guided) robotic linear accelerator-based stereotactic radiosurgery in one session or first fraction		7.00 without imaging included	
(G0340)	(Image-guided) robotic linear accelerator-based stereotactic radiosurgery, fractionated treatment, second through fifth fraction		6.00 without imaging included	
	Total body irradiation		2.5	
	Intraoperative radiation therapy (conducted by bringing the anesthetized patient down to the linac)		10	
	Neutron and proton radiation therapy		2	
	Limb salvage irradiation		1	
	Pediatric Patient under anesthesia		2	
	Adult patient under anesthesia		2	
	<b>Subtotals</b>			
	<b>TOTALS</b>			

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		A	B	C = A x B
	<b>Simple Treatment Delivery:</b>			
77401	Radiation treatment delivery		1	
77402	Radiation treatment delivery (<5 MeV)		1	
77403	Radiation treatment delivery (6-10 MeV)		1	
77404	Radiation treatment delivery (11-19 MeV)		1	
77406	Radiation treatment delivery (>20 MeV)		1	
	<b>Intermediate Treatment Delivery:</b>			
77407	Radiation treatment delivery (<5 MeV)		1	
77408	Radiation treatment delivery (6-10 MeV)		1	
77409	Radiation treatment delivery (11-19 MeV)		1	
77411	Radiation treatment delivery (>20 MeV)		1	
	<b>Complex Treatment Delivery:</b>			
77412	Radiation treatment delivery (<5 MeV)		1	
77413	Radiation treatment delivery (6-10 MeV)		1	
77414	Radiation treatment delivery (11-19 MeV)		1	
77416	Radiation treatment delivery (>= 20 MeV)		1	
	<b>Sub-Total</b>			
<i>For the increased time required for special techniques, ESTV values are indicated below - 1.00 ESTV = 15 minutes</i>				
77417	Additional field check radiographs (port films)		0.5	
77418	Intensity modulated radiation treatment (IMRT) delivery		1.25	
77372	Stereotactic radiosurgery treatment mgmt. Linear Accelerator, 1 fraction		7	
(G0173)		Total body irradiation	2.5	
	Intraoperative radiation therapy (conducted by bringing the anesthetized patient down to the linac)		10	
	Neutron and proton radiation therapy		2	
	Limb salvage irradiation		1	
	Pediatric Patient under anesthesia		2	
	<b>Subtotals</b>			
	<b>TOTALS</b>			