



CAST PROGRAM REQUIREMENTS FOR FELLOWSHIP EDUCATION IN **SPINE**

INTRODUCTION

- Eligibility
 - Fellowship programs which exist within the structure of an ACGME accredited residency in neurological surgery (or the Canadian equivalent) may apply for accreditation through the Committee on Accreditation of Subspecialty Training of The Society of Neurological Surgeons (CAST).
- Definition and Scope of the Subspecialty
 - Neurologic surgery of the spine is that subspecialty of neurosurgery that deals with the evaluation and medical and surgical treatment of diseases of the spine, its supporting soft tissue structures, the spinal cord, the nerve roots and its vascular structures. It includes the in-depth study, prevention, diagnosis, and treatment (medical or surgical) of spinal cord and spinal column pathology.

DURATION/TIMING OF TRAINING

- Post-graduate (post-residency) fellowships:
 - Prior to beginning a CAST accredited neurological surgery subspecialty fellowship, each fellow candidate must have satisfactorily completed an ACGME or a foreign equivalent accredited residency training program.
 - The length of the fellowship will be twelve (12) months duration
 - A CAST accredited program may not offer a fellowship position to a potential fellow until that fellow has completed their PGY3 year.
 - If the subspecialty is part of the match, it is required that programs and fellows participate according to that match's guidelines.
- Enfolded Fellowships:
 - The length of the fellowship will be twelve (12) months duration.
 - A CAST accredited program may not offer a fellowship position to a potential fellow until that fellow has completed their PGY3 year.

- It is expected that all ACGME case requirements will have been met during this Chief year. Prior to beginning their fellowship, the resident candidate must already have a broad exposure to the full spectrum of neurosurgery with sufficient senior level clinical experience to warrant a focused experience to build upon his/her already acquired skills. It is expected that fellow candidates already have both technical expertise and intellectual maturity to understand and apply the material available in subspecialty training (Milestone Level 4).
- If a candidate is pursuing an enfolded CAST-accredited fellowship during their residency, that fellowship training must occur following the Chief Resident year. at the appropriate senior level of residency allowable as valid by the corresponding Joint Section(s) together with CAST.
- The "senior resident level" requirement for participation in all enfolded CAST accredited fellowships (other than neurocritical care) will be after the completion of their Chief Resident year which can be as a PGY6. Candidates passing this bar would be eligible to enter an enfolded fellowship as PGY7.
- If the subspecialty is part of the match, it is required that programs and fellows participate according to that match's guidelines.
- General Description of the Objectives/Goals of Education in the Fellowship
 - The fellowship training must provide broad educational experience in neurological surgery of the spine that will complement that training in the residency to promote further acquisition of knowledge and skills in spinal surgery.
 - The fellowship will be 12 months in duration and fellowship training will be spent in a clinical spine surgery program with experience under the direction of specified clinical faculty. This period of time must provide the trainee with organized, comprehensive, supervised, full-time educational experience in the field of spinal neurosurgery. This should include comprehensive patient care, diagnostic modalities, the performance of surgical procedures, and the integration of non-operative and surgical therapies into clinical patient management.
 - Each fellowship should provide a broad exposure to clinical evaluation and appropriate patient selection for operative and non-operative management in both the inpatient and outpatient settings.
 - Each fellow should actively participate in the operative management of a wide range of conditions which may include a wide range of spinal disorders including traumatic, degenerative, neoplastic and infectious conditions. Progressive responsibility in patient management should be provided. Exposure to modern spinal instrumentation techniques is considered an integral part of the spinal neurosurgery fellowship experience and training.
 - Clinical, anatomic, and neuroscience research constitute an integral component of the educational experience and provision should be made for the successful completion of research projects.
 - Specific competency requirements are provided in Appendix 1. This list of competencies is neither exhaustive nor obligatorily inclusive. However, it is the expectation that most of these competencies will be met.

INSTITUTIONAL ORGANIZATION

- The Sponsoring Program and Institution

- The sponsoring neurosurgical residency program and its affiliated institutions must provide sufficient breadth and depth of operative procedures in spinal surgery to sustain fellowship training.
 - The sponsoring institution should be identified as a regional referral resource for patients with spinal diseases.
 - There must be faculty, administrative, financial resources, research, and laboratory facilities to meet the educational needs of the fellowship trainee and to enable the program to comply with the requirements of accreditation.
- Recognizing the interdisciplinary nature of comprehensive care for patients with complex spinal disease, it is required that within the institution(s) of the fellowship there shall exist clinical facilities and faculty in intensive care, neuroradiology, neurology, orthopedics, and pain management and/or rehabilitation medicine.
- Support for the fellowship program by the sponsoring department/division of neurosurgery must be demonstrated in writing by the program chair at the time of application for or renewal of accreditation.
- Participating Institutions
 - Participating institutions shall be limited to those able to provide the educational environment important for a meaningful, complete fellowship experience with each participating institution having a clinical caseload in excess of 200 operative spine cases per year, of which at least 100 must involve spinal instrumentation.
 - Each fellow must complete at least 150 cases during the 12-month experience.
 - In most instances the spinal neurosurgery fellowship will occur at a single institution. Depending on local circumstances, training may be spent at additional institutions/sites which may provide special resources for training.
 - Any additional sites must be within 50 miles of the primary site to ensure the fellow is given the best educational experience supported by the fellowship program director and core faculty.
 - The primary teaching staff must be members of the faculty of the sponsoring program
 - Only one CAST approved fellowship for each subspecialty per training program will be allowed at any one time.
- Appointment of Fellows
 - In general, only one fellowship position per fellowship training program will be allowed at any time, however accreditation of additional positions will be considered by CAST. In determining the merit of additional fellowship positions, the Committee will consider:
 - The presence of a faculty of national stature in spinal neurosurgery.
 - The quality of the educational program.
 - The quality of clinical care.
 - The total number and spectrum of cases.
 - The quality of clinical and research programs.
 - The quality of fellows trained by the program.

- The impact of fellows on the clinical and educational experience of the neurosurgical residents within the sponsoring program.
- Selection of candidates for the fellowship position must be consonant with the criteria established by the sponsoring program. The fellowship director must adhere to the criteria for fellowship eligibility specified in this document. Appropriate candidates for fellowship position are senior level trainees in or graduates of ACGME accredited (or its equivalent as approved by the SNS CAST) neurosurgical training programs.
- A high rate of fellowship attrition from a program may adversely affect the fellowship accreditation status.

FACULTY QUALIFICATIONS AND RESPONSIBILITIES

- Fellowship Program Director (FPD) Qualifications
 - The fellowship director must be appointed by and be responsible to the chair of the sponsoring neurologic surgery residency program.
 - The fellowship director shall be a neurologic surgeon who possesses special expertise in the evaluation and surgical, medical management of spinal disorders and whose practice is concentrated in the area of neurologic spinal surgery.
 - The fellowship director must be certified by the American Board of Neurological Surgery or possess equivalent qualifications as determined by CAST.
 - The Fellowship Program Director should be an individual with extensive experience and who is considered an expert in the field.
 - The Fellowship Program Director for new program applications must have completed a fellowship in spinal surgery.
- Fellowship Program Director (FPD) Responsibilities
 - The FPD must assume responsibility for the training program and devote sufficient time to the educational program including the following:
 - Preparation of a written curriculum outlining the educational goals of the program with respect to knowledge, skills, and other attributes to be attained during the fellowship. This statement must be distributed to the fellow and members of the teaching staff and be available for review.
 - Selection of fellows in accordance with institutional and departmental/division policies.
 - Selection and supervision of the teaching staff and other program personnel at the institution(s) participating in the program
 - The supervision of the fellow through explicit written directives relative to responsibilities in-patient care as well as supervisory lines. These guidelines must be communicated to all members of the program faculty. Fellows must be provided with prompt, reliable systems for communication and interaction with supervisory physicians.
 - Regular evaluation of the fellow's knowledge, skills, and overall performance, including the development of professional attitudes.
 - The fellowship director, with participation of members of the teaching staff, shall:

- Evaluate the knowledge, skills, and professional growth of the fellow using appropriate criteria and procedures.
 - Communicate each evaluation to the fellow in a timely manner.
 - Advance fellows to positions of increasing responsibility based on satisfactory progression in patient management, scholarship, and professional growth.
 - Maintain a permanent record of evaluations of each fellow and have it accessible to the fellow and other authorized personnel.
 - Provide a written final evaluation for the fellow on completion of the program. This evaluation must include a review of the fellow's performance during the final period of training and verification of the fellow's demonstrated professional abilities and competence for independent practice. This final evaluation should be part of the fellow's permanent record maintained by the institution.
 - Implement all procedures, as established by the sponsoring institution, regarding academic discipline and complaints or grievances pertinent to the fellowship trainees.
 - Monitor fellow's stress, including mental or emotional conditions affecting performance or learning and drug or alcohol-related dysfunction. Fellowship directors and teaching staff should be sensitive to the need for timely provision of confidential counseling and psychological support services to the fellow. Training situations that consistently produce undesirable stress on the fellow must be evaluated and modified.
 - Prepare accurate statistical and narrative descriptions of the program as required by the CAST.
 - Notify CAST regarding major programmatic changes.
- Other Teaching Faculty Qualifications and Number
 - All clinical faculty members who are neurologic surgeons shall be certified by, or be in the certification process of, the American Board of Neurological Surgery or possess equivalent qualifications as determined by CAST.
 - In addition to the program director, the teaching staff must include, at a minimum, one other board certified neurological or orthopedic surgeon who has special expertise in the area of spinal neurosurgery and who concentrates their practice in spinal neurosurgery as defined above.
 - The primary teaching staff should be based at the sponsoring institution or its additional institutions at which the fellow will rotate.
 - All members of the teaching staff must demonstrate a strong interest in the education of fellows, sound clinical and teaching abilities, support of the goals and objectives of the fellowship, a commitment to their own continuing medical education, and participation in scholarly activities.
 - If multiple institutions are approved for participation in the fellowship program, a member of the teaching staff (site director) at each participating institution must be specifically designated to assume responsibility for the day-to-day activities of the fellowship at that institution with overall coordination by the fellowship program director.
 - The faculty must have regular documented meetings to review the fellowship training, the financial and administrative support of the fellowship, the volume and variety of patients available for educational purposes, the performance of members of the teaching staff, and the quality of fellowship supervision.

- Non-physician faculty and other clinical personnel
 - This should include all additional and necessary professional, technical, and clerical personnel to support the program. This includes specially trained nurses and technicians who are skilled in radiological equipment, critical care instrumentation, respiratory function, and laboratory medicine.
 - Fellowship Program Coordinator/Administrator
 - A Fellowship Program Coordinator (FPC)/Administrator must be identified to support the administration and educational conduct of the fellowship. The FPC assists the program director in keeping fellow and institutional case logs, educational programming, evaluation documentation, and supports the program and fellow's(s) day-to-day activities. The FPC is a key member of the leadership team and is critical to the success and accreditation of the program.
 - It is understood that an FPC/Administrator may support more than one CAST-accredited fellowship program. However, to have sufficient time dedicated to the administrative activities necessary to support the program and its participating fellows effectively, it is recommended FPC support should be aligned with effort detailed in the table below.

Number of approved fellow positions across all CAST fellowships within	Minimum FTE Recommendation
1 – 3 fellows	30%
4 – 7 fellows	40%
8 or more fellows	50%

LOGISTICS OF TRAINING

- The Educational Program
 - All educational components of the fellowship should be related to the specified goals and must not interfere with the training opportunities of residents who are members of the sponsoring neurosurgical residency program.
 - The CAST Accredited fellowship program and/or structure must function in synchrony with the ACGME Residency Review Committee (RRC) review of the sponsoring residency program. RRC action against the sponsoring residency program may constitute cause for withdrawal of accreditation by CAST.
- Clinical Components
 - The responsibility or independence given to fellows in patient care must be dependent upon the fellow's demonstrated knowledge, manual skill, experience in the complexity of the patient's illness, as well as the perceived risks of surgical management.

- A portion of the fellowship experience should be allocated to training in an outpatient clinic or office setting which provides preoperative, perioperative, and postoperative continuity of patient care.
- Other Components
 - The fellow must actively participate in scholarly activities and should contribute to the education of neurosurgery residents and medical students.
 - The fellowship program should provide opportunities for the fellow to engage in research related to the subspecialty.
 - Each fellow must have at least one academic contribution as first author in one of the following:
 - peer-reviewed paper
 - book chapter
 - presentation at a major meeting which will need to be detailed in the annual report

FELLOWSHIP POLICIES

- Supervision
 - All patient care services must be supervised by appropriately qualified faculty in accordance with institutional guidelines.
 - The fellow who has completed an accredited neurosurgery residency program may function independently as a junior staff neurosurgeon consistent with institutional and departmental/division policies.
 - The fellowship director must insure, direct, and document proper supervision of the fellow at all times by attending physicians with appropriate experience for the severity and complexity of the patient's condition.
 - The fellowship trainee must be provided with rapid, reliable systems for communication with supervisors.
- Maintenance of Case Logs
 - The fellowship program director must maintain accurate case logs of the spinal neurosurgery case material operated annually within the institution and the subspecialty experience of the graduating chief resident throughout his training as well as that of the fellow.
 - The fellow must maintain an accurate prospective case log of their operative cases throughout the fellowship which documents all operative cases and the level of responsibility in the case (assistant versus primary surgeon).
- Evaluations
 - As noted previously, there shall be written evaluations and constructive discussions of the fellow by the faculty relative to performance and accomplishments of stated goals. These evaluations must occur at a minimum of two times per year and be maintained in a permanent file.

- The fellow shall provide an evaluation of the faculty and fellowship program. This may be submitted either to the fellowship or program director at completion of the fellowship training. This evaluation should be maintained in a permanent file for review by the CAST if requested.
- Duty Hours and Conditions of Work
 - Duty hours and work conditions for subspecialty fellows must be consistent with ACGME, institutional, and program requirements for residency training in neurological surgery for those individuals who are in the last year of residency. Post residency fellow duty hours and work conditions must be consistent with the regulations of the sponsoring institution.

PROCEDURAL/CASE MINIMUM REQUIREMENTS

- Demonstrate competency with all the procedures listed below with fellows having completed a minimum of 150 cases during the fellowship:

CVJ Case / Procedure Type

- Anterior odontoid screw fixation
- Posterior occipital cervical fusion +/- instrumentation
- C12 posterior fusion +/- instrumentation

SUBAXIAL CERVICAL Case / Procedure Type

- ACDF 1 or 2 levels
- ACDF >2 levels
- Corpectomy and fusion +/- instrumentation
- Arthroplasty
- Posterior discectomy or foraminotomy
- Posterior fusion 1 or 2 levels
- Posterior fusion > 2 levels
- Laminoplasty

THORACIC Case / Procedure Type

- Anterior discectomy +/- fusion and instrumentation
- Laminectomy
- Transpedicular decompression +/- fusion and instrumentation
- Costotransversectomy +/- fusion and instrumentation
- Corpectomy and fusion +/- instrumentation

LUMBOSACRAL Case / Procedure Type

- Arthroplasty
- Posterior decompression
- ALIF with LLIF or OLIF
- PLIF or TLIF
- Posterolateral fusion
- SI joint fusion

SPINAL TRAUMA Case / Procedure Type

- Closed reduction of dislocation +/- fusion and instrumentation
- Open reduction of dislocation +/- fusion and instrumentation

DEFORMITY Case / Procedure Type

- Cervical deformity correction
- Thoracolumbar deformity correction (coronal or sagittal)
- High grade spondylolisthesis correction

SPINAL ONCOLOGY Case / Procedure Type

- Corpectomy for tumor +/- fusion and instrumentation
- Resection extradural tumor +/- fusion and instrumentation
- Resection intradural intramedullary tumor
- Resection intradural extramedullary tumor
- Spinal combined extra/intradural lesion any level

MAINTENANCE OF FELLOWSHIP ACCREDITATION

- Each year, the FPD for every accredited CAST fellowship program is required to submit an annual report. CAST will offer continued accreditation based upon review and approval of the annual report. For each annual report, the following must be included:
 - Demographic/contact information for fellowship sites and leadership
 - Full faculty list
 - Detailed block diagram and fellow schedule
 - Institutional case numbers for academic year in review
 - Fellow case numbers for academic year (when applicable)
 - Attestation letter from the fellowship program director
 - Support letter from Chair of department

- Factors that may impact accreditation renewal include:
 - Adverse actions of the Neurological Surgery Review Committee (RC) relative to the parent residency training program
 - Changes in fellowship leadership
 - Failure to maintain a satisfactory volume of cases
 - Major changes in the fellowship faculty
 - Failure to provide adequate administrative support
 - Failure to complete required annual reports completely and accurately.

Appendix 1: Competency Requirements of Spine Fellow for CAST accreditation.

I. Clinical Competencies:

- General

- Demonstrate advanced knowledge of the anatomy and physiology of the spine and the central nervous system relevant to the management of spine and spinal cord pathologies.
- Demonstrate advanced knowledge of clinical features including signs, symptoms, natural history, and prognosis of spinal traumatic, infectious, metabolic, neoplastic, degenerative, developmental, and congenital spinal disorders.
- Demonstrate the ability to conduct a thorough history and physical examination for various chief complaints that pertain to the spine.
- Demonstrate the ability to provide a thorough differential diagnosis for a variety of spine complaints.
- Demonstrate effective communication with the clinical team, patient and family members regarding various treatment options, including operative versus non-operative options in spine care.
- Demonstrate advanced knowledge of the recognition and treatment of intra-operative, peri-operative and post-operative surgical complications pertaining to spine surgery.
- Understand the principles of electrophysiological techniques used to assess spinal peripheral neural and spinal cord pathology including EMGs, nerve conduction studies, evoked potentials and multimodality intraoperative monitoring.
- Understand the principles of imaging assessments including, plain radiography, myelography, radionuclide scans, CT, PET, SPECT/CT, and MRI.
- Understand the principles of radiation safety in treating spinal disorders.
- Degenerative
- Demonstrate a comprehensive knowledge of the diagnosis and treatment of degenerative spinal disease.
- Demonstrate the ability to use evidence-based medicine decisions when making recommendations regarding operative versus non-operative treatment of the degenerative spine.
- Demonstrate proficiency in the diagnosis and knowledge of medical and surgical management for spondylosis including neurologic effects such as radiculopathy, neurogenic claudication, myelopathy and cauda equina syndrome.
- Demonstrate the ability to compare and contrast the surgical treatment options for cervical spondylotic myelopathy and ossification of the posterior longitudinal ligament, including knowledge of procedures such as multilevel anterior cervical discectomy or corpectomy and fusion, laminectomy, laminectomy and fusion, and laminoplasty.

- Trauma

- Recognize the need for urgent immobilization of the spine when instability is suspected.
- Demonstrate the ability to classify injuries according to fracture morphology, instability, and neurological status. Identify syndromes of spinal cord injury, including complete transverse injury,

anterior cord injury, Brown-Sequard injury, central cord injury, posterior cord injury, cruciate paralysis, syringomyelia, conus syndrome, and sacral sparing.

- Discuss the indications for acute reduction, decompression, and stabilization as appropriate in the setting of a polytraumatized patient.
- Discuss non-operative and operative treatment options for fractures and dislocations affecting the spine. Compare and contrast the indications for anterior and posterior spinal fixators in the management of thoracolumbar trauma.

- Infectious

- Demonstrate the ability to perform an appropriate history and physical examination in situations where primary, secondary, or post-operative spinal infection is suspected.
- Demonstrate the ability to order and interpret appropriate diagnostic tests to confirm infection and identify the causative organism.
- Demonstrate knowledge on the recommended medical management of infectious lesions of the spine, such as vertebral osteomyelitis, discitis, and epidural abscesses
- Demonstrate knowledge of the indications as well as appropriate surgical procedures required in the management of spinal infections

- Oncology & Vascular

- Demonstrate competency in establishing a diagnosis of neoplastic spine disease based on clinical presentation and imaging
- Demonstrate knowledge of the indications for posterior / posterolateral decompression, anterior decompression, or radiotherapy in the setting of primary or metastatic spine tumors
- Demonstrate knowledge on the differences between conventional external beam radiation therapy and newer radiosurgery / stereotactic body radiation therapy (SBRT) options in spine oncology treatment
- Demonstrate an understanding of the principles of tumor surgical resection including knowledge of the indications for en bloc resection of tumor versus intra-lesional debulking
- Demonstrate an understanding of the surgical techniques required for treatment of extradural vs intradural-extramedullary vs. intramedullary spinal tumors.
- Demonstrate the ability to recognize spinal vascular malformations, such as arteriovenous malformations, dural arterio-venous fistula, and hemangiomas, including knowledge of treatment options for spinal vascular conditions

- Deformity

- Demonstrate the ability to perform a history and physical examination appropriate for a patient presenting with spinal deformity
- Demonstrate the ability to describe the classification systems for scoliosis, kyphosis, and spondylolisthesis, and craniocervical deformities
- Demonstrate the ability to evaluate spinal balance, flexibility, as well as knowledge of lumbosacral/pelvic radiologic parameters considered important to structural spinal balance

- Research & Continued Medical Education
 - Demonstrate knowledge of concepts specific to research in the spine, both surgical and non-surgical conditions.
 - These include the development of a research question, hypotheses and specific aims, knowledge of study design, interpretation and critical evaluation of the spine literature
 - Develop critical appraisal skills with respect to analyzing literature as is pertinent to a spinal surgery practice

II. Procedural Competencies:

- General
 - Demonstrate Proficiency in:
 - Patient positioning, prepping and draping
 - Use and application of Gardner-Wells tongs for traction
 - Use and application of halo ring for traction
 - Use and application of halo and vest
 - Closed reduction techniques for spinal disorders
 - Bone graft harvesting techniques
 - Management of intra-operative and postoperative complications such as dural tears, nerve root injury, hemorrhage, epidural hematoma causing neurologic compression, pedicle screw breaches, persistent CSF leak, and surgical site infection
 - Utilization of magnification including a microscope and/or loupe for spinal surgery.
 - Maintenance of cervical spine precautions during prone positioning (i.e., Jackson table with Mayfield pins and adaptor)
- Cervical Spine
 - Demonstrate the ability to carry out both anterior and posterior cervical spine approaches
 - Demonstrate proficiency in the closed and open treatment of cervical spine fractures and dislocations
 - Demonstrate the ability to properly place C1 and C2 sub-laminar cables
 - Demonstrate proficiency in multilevel posterior laminectomies with and without foraminotomies
 - Demonstrate proficiency in the ability to implant cervical lateral mass screws, including plate/screw and rod/screw instrumented constructs
 - Demonstrate the ability to implant cervical trans-laminar screws for cervical stabilization procedures
 - Demonstrate the ability to safely implant lower cervical/upper thoracic pedicle screws
 - Demonstrate the ability to perform upper cervical instrumented arthrodesis procedures, including the ability to insert C2 pars screws, C1-2 (Magerl) trans-articular C1-2 screws, and the Harms/Goel (i.e., C1 lateral mass and C2 pars/pedicle screw/rod) technique for the management of upper cervical spine disorders

- Demonstrate the ability to perform both single and multilevel anterior cervical discectomies and corpectomies with instrumented fusion
- Demonstrate the ability to perform a multi-level posterior cervical laminoplasty with instrumentation
- Demonstrate proficiency in performing an occipito-cervical instrumented fusion, including the ability to properly place occipital fixation
- Demonstrate proficiency in performing a posterior cervical-thoracic instrumented arthrodesis
Demonstrate the ability to perform a cervical odontoid screw fixation
- Demonstrate proficiency in revision decompression with or without revision instrumented fusion of the cervical spine

- Thoracic Spine
 - Demonstrate proficiency in performing posterior/posterolateral transpedicular, costo-transversectomy and lateral extra-cavitary approaches to the thoracic spine
 - Demonstrate the ability to properly place pedicle screws in the thoracic spine
 - Demonstrate the ability to properly place laminar, transverse process, and pedicle hooks in the thoracic spine
 - Demonstrate proficiency in performing a postero-lateral thoracic discectomy
 - Demonstrate proficiency in performing anterior thoracic discectomy
 - Demonstrate proficiency in performing an anterior thoracic vertebrectomy with reconstruction
 - Demonstrate proficiency in performing a posterior multi-level thoracic decompression and fusion
 - Demonstrate proficiency in surgically managing thoracic spinal fractures with and without cord compression
 - Demonstrate proficiency in revision decompression with or without revision instrumented fusion of the thoracic spine
 - Demonstrate proficiency in managing both sagittal and coronal plane deformities of the thoracic spine with instrumentation
 - Demonstrate proficiency in spinal osteotomies for the treatment of deformity and tumor

- Lumbosacral Spine
 - Demonstrate proficiency in performing single and multi-level posterior lumbar discectomies, decompressions and instrumented fusions
 - Demonstrate proficiency in performing anterior/anterolateral spine surgery
 - Demonstrate proficiency in performing lumbar fusion and/or decompressive surgery for lumbar spinal fractures with and without neurologic injury
 - Demonstrate proficiency in the placement of lumbar pedicle screws
 - Demonstrate proficiency in performing lumbo-sacro-pelvic instrumented fusions, including the placement of sacral alar and iliac screws
 - Demonstrate proficiency in performing interbody fusions from several approaches (including anterior, lateral, and posterior approaches).
 - Demonstrate proficiency in revision decompression with or without revision instrumented fusion of the lumbar spine
 - Demonstrate proficiency in the use of minimally invasive spine surgery techniques for decompression and instrumented fusion

- Demonstrate the ability to approach the lumbar spine via a minimally invasive lateral transpsoas approach for implant placement, decompression and/or fusion
- Other
 - Demonstrate proficiency in the use of intra-operative image guided navigation systems (2D, 3D) for spinal disease.
 - Demonstrate proficiency in performing vertebral augmentation procedures such as vertebroplasty and balloon kyphoplasty for spinal disease.

