CHAPTER TWO

OVERVIEW OF THE NEUROSURGICAL ILLNESS JOURNEY AND CARE

The nervous system is a quiet complex system and does not complain. Early on, patient may complain of general non specific problems, such as "arthritis like feeling" or "migraine like headache". These "general" complaints get overlooked by the patient. It continues to progress but over time so becomes unnoticed until it reaches serious stage. Patients are the only person that can help himself or herself to get early assistance. Patient awareness of the nervous system illness therefore becomes essential for early diagnosis. The current book may assist the patient and provide a "map" from other patients that may guide other patients.

What a privilege God the Almighty has given to his children to be able to explore and surgically heal other fellow men! Not long ago, it was told that surgery on the fellow men is impossible and not a gift given. In the first three volumes, the author discussed the holistic brain, the master mind of mankind. Perhaps, the new technology may get signals from the brain to the outside world replacing some of the neural network. But never, ever, should it replace the brain, the person's identity and eternal existence. The brain is a sacred irreplaceable organ so the nervous system should be handled accordingly. For generations, we realized that injury to the nervous system is limited in reparability and the best thing is prevention and if injured, act immediately. There are many new things on the horizon, but today, the brain remains almost irreparable and regeneration is very much limited. New development

in the neuro-technology, neurocomputer interface where brain signals of intention to do a task can be picked up by sensor transferred wirelessly to a computer or to artificial limbs and patient able to communicate to outside world. All our deeds arise from the brain and are conducted through the nervous network, and mankind is able to navigate his daily activity in the environment. But as Our Lord said "all what comes from within---et". The brain cells are ßable to generate detected electrical signals called evoked potentials and spikes. These spikes get intensified as they are activated when these specific neurons intended to do a specific task. If these neurons are picked up from the motor strip, then it is muscle movements, if from vision area, they will be activated from the scene. And so forth. The new technology may help to assess or restore some functions to stroke or spinal cord injured patients. It may allow the brain of quadriplegic patient to move an outside virtual arm but it needs the brain of the person and it will work through the mastermind.

The journey for surgery on the nervous system is scary and not easy. It was not long ago when man thought that no man survives after surgery on the nervous system. That has changed. Even currently many of patients will say "you are not going to make a hole in my brain". Rightly so, many of the fears related to the neurological paralysis and loss of function. Patients understood clearly that brain and nerves are essential and damage will result in a loss of function. Surgery in the nervous system is a mark of the recent technology of the 20th century and many things are still to understand or figure out. Frequently asked concerns, will I be the same after the surgery? Will I wake up paralyzed? Will I become vegetative "vegetable alive by the machines? Will I recognize my family? And so many questions and concerns.

It is my belief that many brains will have recovered from major injury if we give enough time to heal. When we injure the brain, the patient goes back to the child's brain and becomes dependent. The child's brain takes 18 years to mature. So with the brain plasticity and ability to generate, perhaps time is needed to support the brain and nervous system for recovery.

CAUSES AND MANIFESTATION OF NEUROSURGICAL ILLNESS

The nervous system, brain, spinal cord and nerves do not tolerate compression. In fact, the most common reason for surgery on the nervous system is to remove the external or internal pressure. The compression can be caused by

many reasons such as tumors, disc herniation or collection of blood. Magnetic reasonance imaging (MRI), computerized tomography scanner (CTSCAN) and x-rays are the diagnostic imaging to visualize the nervous system and the problems. When pressure exerts on the nervous system acutely (all of a sudden) it is not tolerated as much as if it is gradual. For that reason, sudden disc herniation (when a piece of disc get extruded and pushes on the nerve) it will produce sudden severe sciatica where pain like toothache travels all the way from the back to the leg. Also, when sudden brain hemorrhage can squeeze the brain inside the skull and the patient will drift into coma from being awake after a brief episode of headache. Removing the focal disc material will relieve the sciatica and removing the hemorrhage collection will release the pressure from the brain.

If however, the compression on the nervous system occurs gradually (chronic), the nervous system will adapt and symptoms and signs early on will be minimal. For instance, patient was hit on the head and a small hemorrhage occurred and gradually increased in size, the patient will have headache for some time, then gradually drift into confusion and he or she becomes sleepy and sleepier when it continues to reach large size.

Most common manifestations for neurosurgical lesions are headache and pain. The nervous system is tedious and difficult to diagnose because it does not complain. Paying attention to details with diary of the daily complaints is helpful when you share with your physician. Detailed history and examination is needed and early referral to specialist is recommended. Time is "brain" is common rule and when the problem gets diagnosed early on, more options are usually available and success of intervention is high. Early on symptoms can be confusing especially of brain problems because they are non specific and can match common daily complaints. For instance, headache occurs in more than 90% of the population and in some are daily complaints. Early on, patient may complain of general non specific symptoms, such as "migraines like headaches" or "lightheadedness like flu". These "general" complaints get overlooked by the patient. It continues to progress but over time so becomes unnoticed until it reaches serious stage. The patient is the only person that can help him or herself to get early assistance. Patient awareness of the nervous system illness therefore becomes essential for early diagnosis. The current book may assist the patient and provide a "map" from other patients that may guide other patients.

So how can we know which one is dangerous- more than another? Usually the patient will know that the ominous headache is sudden, severe and different from all other headaches and can be associated with new complaints such as lightheadedness, sleepy, drowsy, blurry or double vision, word finding difficulty or slurred speech, confusion, ringing in the ears (tinnitus), feel like

spinning (vertigo), numbness in the face, drooling of the face, starring look, difficulty swallowing, choking sensation, numbness in one side, heaviness in the arm or the leg, walking difficulty or gait disturbance, fever, neck rigidity, stiffness of the arms and legs, involuntary movements and seizures. More specific finding can be searched for like reaction of pupils to light, dancing eyes (nystagmus), and abnormal posturing. For the level of the coma, there is a scale that can evaluate the depth of the coma and standardized across the world. Glasgow coma scale is the most common and used for patient exposed to head trauma and suffered from traumatic brain injury (TBI). If there is no response, the score is 3 and if the patient is fully awake and normal is 15 and if severe <8. It includes eyes opening spontaneously and pain, speech output and response of the arms and legs spontaneously and to pain. When the coma is deep, pinching the arms or legs cause "abnormal posture" response, flex (decorticate" or extend (decerebrate). Patient will not answer questions or "follow command". As the pressure increase before the coma, the patient appear confused and "disoriented where he does not know where "place", when "time "and what "person". It is not uncommon that deterioration in the mental status occurs so rapid that one minute looks awake and next minute is in coma. For that reason, head injury is taken seriously and be admitted for "neuro-observation".

The brain is a quiet organ and when it reaches a certain stage, "critical level" drifts into coma and death occurs in no time. Be on alert and be observant is the key for salvage. Brain "herniation" is a terminal event which occurs when the pressure on the brain gets ignored and the brain gets squeezed more and more inside the skull where there is no room except to squeeze the essential part of the brain through rigid membranes and openings such as "tentorial incisura" for tentorial herniation, subfalcine herniation and tonsillar herniation. Once herniation occurs if intervention by surgical release of pressure do not take place within minutes to maximum of two hours, permanent destruction of the brain occurs and "brain death". It is important to realize before declaring a person "brain dead" that the person is not hypothermic (temperature <95F), or has sedative drugs or neuromuscular blockade on board. It is ideal to be aggressive in the treatment of patient for the first 24 hours and in children to 72 hours and continue documentation of "brain dead" examination regardless of the maximum treatment received. Things change later and for that reason, doing the maximum in the beginning before it is too late is essential. The "brain dead" examination includes no response what so ever to pain, no cough when tube placed inside the throat and trachea, no gag when tube placed inside the mouth , no spontaneous respiration, no corneal reflex when stimulation to the cornea, no reaction to the light applied at the pupils, no eye movements when the head is moved and

eyes open, no movement of the eys when iced water applied to the ears. Eyes are not open to pain, arms and legs are not moving to deep pinching pain. When the respiratory machine stops temporarily, despite good oxygenation, patient will not initiate spontaneous respiration even at arterial carbon dioxide level >60mmHg "positive sleep apnea" test. Electroencephalogram will show flat line or e "isolectric EEG", blood flow study will show no blood flow to the brain and transcranial Doppler will show biphasic flow.

When pressure occurs on the nerve, pain and tingling and numbness sensation travels through the nerve to the area where the nerves supply. A "dermatome" for sensation and "myotome" for motor. In the neuro-anatomy, each nerve has special distribution of the human body and from following the course of the dermatome and myotome, we can know which nerve is affected. This traveling aching pain and numbness is called "radiculopathy" and it is known as "sciatica" if it affects the legs. MRI, CTscan and X-rays are the imaging ordered to look for the problem affecting the nerve root in the spine. Early one, patient may complain of general non specific such as "arthritis like feeling" in the arm or the leg, numbness in the hand or joint pain. These "general" complaints get overlooked by the patient. It continues to progress but over time so becomes unnoticed until it reaches serious stage. The patient is the only person that can help him or her get early assistance. Patient awareness of the nervous system illness therefore becomes essential for early diagnosis. The current book may assist the patient and provide a "map" from other patients that may guide other patients.

SURGICAL TERMS

Speed and diligent treatment go hand in hand in skilled hands during neurosurgical procedures.

BRAIN

Brain is the master region of the nervous system. All nervous signals, communications and response occur within the brain. It is the mother of the nervous system. It weights 1500 gram outside the body but inside the skull carries no weight. It attaches itself through filaments and swims in water called cerebrospinal fluid. The distal part of the brain transit to brainstem (two fingerbreadth) and spinal cord "one finger breadth". Billions of tracts and fibers travel through the spinal cord and brain stem. Most of the structure within the nervous system cannot be seen or identified by the naked eye. That is why, microscopic magnification and illumination are needed when surgery

is done on the nervous system. The nervous system does not handle pressure well, or stretch. For that reason, it is hidden and protected within the bone boundaries of the skull for the brain, and spinal canal for the spinal cord.

SPINAL CORD

Spinal cord descends through the spinal canal after passing through the inferior opening of the skull. It carries tracts and fibers connecting the brain to the outside environment with many signals back and forth at any give time. The spinal cord travels through the neck and upper back part of the spine and ends. At each level it gives two nerves one at each side and supplies arms (cervical cord), chest and abdomen (thoracic cord) and pelvis and legs (lumbosacral cord). These nerves as they exit the spinal canal forms network of nerves called plexuses (brachial for the upper and lumbosacral for the lower nerves. Then the plexuses give rise all the nerve branches to the arms and legs.

SPINE:

The vertebral column or spinal column where all vertebral bodies one above another to form a long column to hold us upright. The spinal column is divided into regions starting from the top. Cervical for spinal column in the neck, Thoracic for the spinal column in the upper back, Lumbar for the spinal column in the lower back and sacral for the spinal column in the pelvis. Each region consists of several vertebral bodies and named numerically. For instance C3 means vertebral body of the third cervical vertebra. Between each vertebral body and another there is a disc and named numerically by the vertebral body above and that below for instance C3-C4 disc is the disc located between the vertebral bodies C3 and C4. In the cervical region there is seven vertebral bodies and eight nerves. The upper four nerves supply the head and neck on that side. The lower cervical nerves supply the entire arm. Each nerve is named by the above vertebral body for instance C4 nerve root is the nerve root exiting below C4 vertebral body. Each nerve root has special distribution to the arm both sensation and motor. When the nerve root gets affected by disc herniation, the pain, numbness and weakness reflects the sensory and motor supply by the nerve root. At each spinal region, the back part consists of laminae , spinous process and facets, laterally is the foramen where the nerve exit and anteriorly is the vertebral body and discs. In the center is the spinal canal where the spinal cords and nerve roots are located. They are covered with rigid membrane called dura.

LAMINECTOMY, means the posterior part of the spine, laminae is removed
LAMINOTOMY means part of the lamina is removed
FORAMINOTOMY, means the canal where the nerve root travels is decompressed, enlarged and open
MICRODISCECTOMY, means the herniated disc fragments are removed and what is left behind is the firm disc
FUSION OF THE SPINE, means bone materials with or without instrumentation is placed between vertebral bodies and posteriorly to allow bone fusion to occur over time. Usually, the entire disc is removed and replaced by solid bone or cages and hold together by hardware.
CRANIOTOMY, means part of the skull is temporary removed to get access to remove the lesion (blood or tumor-) and placed back again in place
CRANIECTOMY, means part of the skull is removed permanently
RESECTION, means removal of the lesion such as tumor
DEBULKING, means take as much as safely be removed
ANEURYSM CLIPPING, means applying a metal clip at the origin of the aneurysm to cut off the circulation so that no more blood goes inside

NEUROSURGICAL DISCPLINES AND EQUIPMENTS

NEURO-OPERATING ROOM

The neurosurgical procedures are being held in the operating room suite specialized for these patients. Most of the equipments are available and mounted to the ceiling and in the close proximity. The neuro-lead nurse and Neurosurgical nurses are well trained in the various neurosurgical procedures. Many types of equipment are used. Therefore, they are all located in these rooms in special arrangement. Trafficking inside such rooms is well examined. Equipment and neurosurgical steps are rather complex and with specialization things are made efficient and easy. Speed and diligence go hand in hand in skilled hands. The patient is positioned in a certain way to facilitate exposure of the surgical field and provide direct access to the lesion. For brain surgery, the head is well fitted over "a horse shoe" like frame where the head will not be tilted. Otherwise a good fixation to the head is by applying one pin in one

side and two pins on the other side and these pins are held on a frame called Mayfield head holder and the head is fixated by the pressure exerted on the pins through the skull. For the spine, the patient is placed on supine if the access of the surgery is from the front such as cervical discectomy or anterior lumbar discecomy where the surgical access is through the neck retracting the trachea and carotid vessels to the side away from the spine or through the abdomen retracting the abdominal vessels and organs away from the spine, respectively. The field is sterilized with providine or chlorohexidine. Prophylactic antibiotics are administered by the anesthesiologist prior to the incision. "Time out" is called where the nurse read in a clear voice and confirm with all the staff in the room the correct name of the patient, procedure, allergy, antibiotics and special instruments. In the meantime, before the patient enters the room, 2-3 operating nurses are already in the room with gowns and masks preparing all the instruments and "setting" the room to be ready for surgery. All the instruments are out of the® kits and displayed in order of its use during the surgical steps. After positioning and prepping and drapeing the surgical site, incision is being made and being marked as the start time of surgery. Dissection continued through the layers of the skin, subcutaneous tissue and muscles all the way to the bone. The electric or nitrogen drill is used to drill the bone away. The surgical loupes are being used will be removed and microscope will come to the field. The dura, rigid membrane covering the spinal cord, nerve roots and brain become visible. The external pressure will be removed using various microdissectors. Suction device is essential to clear the field in regular fashion; Bipolar is used to coagulate the offending bleeders away from the neural and essential tissues. External or epidural lesions will be removed at this time. If the lesion is intradural or internal, then the dura is opened with pick up with teeth and micro knife blade is used to sharply cut the dura. Gentle handling of the nervous tissue, the arachnoid and subarchnoid space is identified. The nervous tissue is pulsating, clear, well organized and many of microvasculature arranged in arrays seen. Small retractors are developed to protect the neural tissue while accessing the lesion. The instruments are changed to more microinstruments and magnification is increased and illumination directed deeper in the field. The steady hand will work with microinstruments to reach the lesion and removing it in piece by piece without affecting the essential tissues. Many instruments with different names and have different purposes. Examples are microdissector to dissect tissues, nerve hook to hold the nerve, forceps to remove small pieces. After removing the lesion, good hemostasis should be obtained where no blood is seen and irrigation is crystal clear, dura is closed with nonabsorbable monofilamants. Strong surgical ties are the key. The bone is placed back and held in place by microplating system and microscrews for

the skull. The muscle layer is then closed and skin is approximated by sutures or staples. Subcutaneous drain may be placed to drain subcutaneous blood accumulation. Tight and sterile dressing is applied. Sutures are usually removed in 7-10 days postoperatively. The entire nursing notes, events, and products used will be part of the patient chart.

SURGICAL LOUPES and MICROSCOPE: During surgery of the nervous system, the neurosurgeons utilize special equipment to provide magnification of the field and strong illumination. This is achieved by using surgical loupes, the microscope and endoscopic systems. The small few millimeter nerve can appear larger and brighter. Advance in technology made neurosurgery possible.

BONE DRILL: The nervous system is protected within strong bone boundary skull and spine. In order to reach the brain or the spinal cord/ nerves, special Drill is used to remove the bone without pressure over the nerve or the brain or the spinal cord. The drill makes thousands of revolutions and drills the bone away under direct supervision.

IMAGE GUIDANCE: When the field is magnified, the three dimensional perception gets affected as well as the location of the tumor has to be precise. Instead of guessing or going through normal tissue to look for the tumor. Image navigation system developed like GPS system (used in our cars daily) will assist the surgeon to locate the tumor. Other equipments may include a preoperative MRI sothe patient is referenced to the computerized system. The surgeon will be able to localize the tumor within the space and guide the surgery. Intraoperative ultrasound can localize the lesion and also intraoperative MRI. So before the surgery is completed, the tumor is removed. Intraoperative x-ray, fluoroscopy and CT scan can also be used to guide where the screws are placed and avoid the nerves.

HEMOSTATIC EQUIPMENT: To stop bleeding from the bone, wax is applied, electrical bipolar is used to coagulate blood vessel bleeder, hemostatic agents such avitin and gelfoam are used to form a coagulum and stop bleeding.

IRRIGATION: Brain, spinal cord and nerves are surrounded with fluid called cerebrospinal fluid. During surgery, we avoid dryness of the brain, spinal cord and nerves. Irrigation using sterile solution is done in regular fashion

TUMOR DEBULKING; Many equipment developed over time to take away the tumor piece by piece without pressure in the surrounding healthy tissue. These may include ultrasonic aspiratory, suction, microscissors

INTRAOPERATIVE NEUROPHYSIOLOGICAL MONITORING

Under anesthesia, part of the nervous system is asleep and there is no way to know how different nervous tracts are being affected by surgery. So Neuromonitoring system was developed to test the tracts regularly under anesthesia without waking the patient up. On occasions surgery can be done while the patient is awake and called "awake craniotomy". This is usually done when the tumor is located in the dominant site of the brain close to the speech, motor and reading areas. The patient will receive local anesthetics"numb medication". Spontaneous brain activity is recorded and called electroencephalography (EEG). Evoked potentials are also recorded by applying stimulation to the nervous tract. For instance electrical stimulation is applied to the nerves in the arms, median nerve and legs, posterior tibial nerve, potentials are propagated through the nerve to go inside the spinal cord and then to the brain. These potentials are picked up from the scalp under anesthesia and are called somatosensory evoked potentials "SSEP". It will provide continuous information about the posterior tract and sensory system. Similarly, auditory brain stem potentials (BAER) are recorded from the scalp after applying auditory clicks in the ear. The potentials travel through the brainstem in the hearing pathway. Visual evoked potential travel through the visual pathway from the eye to the occipital lobe and potentials are picked up from the scalp. Averaging amplifier equipment made it possible to revord the microvolt potentials under special anesthetic regimen used. Neurophysiologist technician usually runs the computer, gives immediate feedback to the neurosurgeon and anesthesiologist of any change. If the surgeon is close to a critical area, he will back off until the potentials recover and reassess the next steps. The waveforms and final report will be part of the surgical report and intraoperative nursing notes and anesthesia records

INTERVENTIONAL NEURORADIOLOGIST

A physician trained to perform neuro-radiologic procedures in the radiology suite under imaging machines. These procedures can include "coiling" of an aneurysm where coils are placed in the brain aneurysm through micro catheter advanced from the groin femoral artery to the brain. It's purpose is to obliterate the aneurysm. Brain arteriovenous malformatiom (AVM) embolization where, chemical substance administered to the AVM nidus through micro catheter advanced through the groin femoral artery. It's purpose is to obliterate the AVM in stages. Other techniques may include placement of cement which can be can be administered through a needle to the bone to strengthen osteoporotic or weak bone.

NEUROANESTHESIOLGY

Anesthesia for the nervous system is called "neuroanesthesia" and there is specialist called "neuroanesthesilogist". Administering anesthesia for the nervous sytem requires good understanding of the patient condition and underlying problems. This will modify the anesthetic mangment to be tailored to the patient. Anesthetics are given to provide strong pain relief, anesthesia, amnesia and no movement during surgery. Other special medications and techniques are administered to decrease the pressure or prevent increase the compression on the nervous system. This may include dexamethazone (steroid medication), mannitol (osmotic diuretic), furosamide (water pill), hyperventilation (increase in respiratory rate to wash carbon dioxide from the blood) and strong sedative hypnotic such as barbiturates. If the cervical cord is compressed, while the patient is awake,awake fibroptic intubation is done through the mouth which is "numbed up" and special scope is passed through the trachea and then the endotracheal tube (7-8mm) and secured in place. Then anesthesia is induced and patient drifts under anesthesia the ventilator machine ventilate the lungs and allow anesthestic gases such as sevoflurane, desflurane and isoflurane pass through and anesthetize the brain. During fibroptic intubation, the spinal cord is protected against spine kink and paralysis. Otherwise anesthesia medication is usually diprivan "propofol" or thiopentone "barbiturate in a dose calculated by the weight of the patient given through intravenous catheter started in the holding area. A muscle relaxant is given to prevent movement during induction, intubation and surgery. These neuromuscular blockade agents named suchniylcholine, rocuriunum, vecuronium and cistacarium. Intravenous anesthetics are usually administered during neuroanesthesia by continuous infusion such as propofol and strong analgesic 100-200 fold more stronger than morphine such as fentanyl and sufentanil and remifentanil. When neurophysiology monitoring is used, anesthetics are selected in such a way to maintain the evoked potential recording and usually viaintravenous anesthetics.

Neuroprotective agents are administered to protect the brain during ischemia and when vulnerable brain is needed. These agents can be barbiturates, isoflurane, etomidate. Other measures include hypothermia, 34C and hypertension. Many other agents are underway. So when the neurosurgeon works in a vital area and the blood flow is being interrupted using such "neuroprotective measures" can help out during this period without causing stroke. Similarly, if the pressure inside the brain increased so that the brain is coming out of the skull, the neuroanesthesiologist can use measures to decrease intracranial pressure such as osmotic diuretics mannitol and furosamide where decrease the brain water content, hyperventilation where

carbon dioxide in blood is lower and subsequently the blood vessel constricts and anesthetic agents which suppresses ICP. Awareness under anesthesia rarely occurs. It usually indicates not sufficient anesthetics while patient is feeling and can not move. Anesthesiologists are trained to be aware to use enough anesthetic to ensure patient under anesthesia, selective administration of neuromuscular agents and use of EEG monitoring.

Emergence from anesthesia is when patient is allowed to wake up by allowing time for anesthetic to wear off. The endotracheal tube will be removed once patient can breathe on his own and protect his airway and respiration. Anesthetics are tailored so that immediately after surgery is concluded, the neurosurgeon can assess the patient via a neurological examination before he leaves the operating room.

The anesthesiologist will pay a visit postoperatively to the patient to evaluate his or her condition and focus specifically on awareness, neurological deficits, position related complications and patient satisfaction with the perioperative experience. The anesthesia record will include pre, intraoperative and postoperative anesthetic care.

POSTANESTHETIC RECOVERY CARE UNIT (PACU)

In post-anesthetic area, anesthesia personnel will provide observation especially of airway, oxygenation, ventilation, difficulty breathing, vomiting, pain and low or high blood pressure.

NEUROCRITICAL CARE (NEURO-ICU)

Patients with neurological and neurosurgical conditions are recommended to be cared for in the Neurointensive care unit by a Neuro-intensivist who works with other physicians and surgeons. In the neuro-ICU, all staff are aware, skilled and well trained to care for the nervous system. It is well equipped with the neurological equipment needed. It reflects excellence in care delivery. Measuring intracranial pressure is essential in severe head injury and when the pressure is high. Normal intracranial pressure (ICP) is 5-10mmHG. By placing a fibroptic probe within the brain substance (Paryncymal), or inside the ventricle (external ventricular drain) the ICP can be measured minute by minute. The procedure is done at the bedside in the Neuro-ICU under sterile condition. Staff is trained to use measures to lower ICP such as, head neutral, avoid neck kink, hyperventilation, sedation, osmotic diuretic and drainage of CSF. If the pressure continues to increase, then hypothermia, barbituate coma and decompressive hemicraniectomy can be options. By removing most of the expanding hematoma, the necrotic dead brain can be helped especially if done in a timely manner. Maintain cerebral perfusion pressure "CPP" where the

pressure inside the brain is subtracted from the mean arterial blood pressure which indicates brain perfusion and should be above >70mmHg.

PAIN SPECILAIST

Is a physician who is trained and experienced in pain management. The pain specialist can administer through needles pain relief medication at the site of the problem without causing nerve injury. So instead of the medication be given by mouth or vein or skin, it is administered in high dose to the site of the problem to relieve the inflammation and apply some relief and avoiding systemic toxicity. These medications include dexamethazone, local anesthetics , with or without narcotics.

RECOVERY

"In fact, in my experience, the best outcome and recovery takes place when there is committed highly educated and skilled family member with strong positive attitude"

Patient will remain in the hospital until no need for hospital care. Usually 1-2 days in the neuro-ICU, then regular neuro-ward. During hospitalization, frequent monitoring of all the vital signs include blood pressure (BP), respiration (RR), heart rate (HR), temperature and oxygen saturation (O2Sat). Total intake of fluid and output (Is and Os) are counted for, daily weight, complete physical and neurologic examination followed by limited examination directed for the area of interest. Hospitals developed various "protocols" to standardize, manage common medical problems and prevent common issues. These protocols may include tight stocking and pneumatic compression boots applied at the legs and subcutaneous heparin/ levonox to prevent deep venous thrombosis, laxatives to prevent constipation, O2 therapy to treat poor oxygenation "hypoxemia", electrolyte protocols to treat low serum minerals like sodium, potassium and magnesium, insulin sliding scale to treat high blood sugar "above 120-150mg/l", morphine or hydromorphine patient controlled analgesia to control pain. Many other services called ancillary services that will care for the patient in entirety include physical therapy (extremity exercises and walking), occupational therapy (hands and daily activity tasks), speech therapy (cognitive function and swallow study), respiratory therapy (lung exercises and respiration), nutritionist (dietary consult), social worker, case manager, discharge planner, patient advocate and spiritual healer.

When patient is ready for discharge from the hospital arrangement will have been processed over the last days in the hospital and all recommendations with each physician name, address and contact information are written with prescriptions and physical recommendation with "follow ñup plan of care". A 24 hour/ 7 days a week supervision and care giver preferably by a close family member is highly recommended. In fact, in my experience, the best outcome and recovery takes place when there is committed highly educated and skilled family member with strong positive attitude. Instruction is given to the patient and what to look for, briefly fever, increase headache, numbness or tingling in the arms or legs, confusion, black out "syncope", wound drainage, persistent nausea, vomiting, difficulty ambulation, difficulty urination, abdominal distension, persistent constipation, shortness of breath, chest pain, skin rashes or new symptoms or physical appearance of concerns. Notification to the physician and attendance to urgent care or emergency care center is recommended according to the condition. Patient will then go to home with or without home health services. Home health services may include nursing, nursing aid, and other ancillary services and home equipment. Patient may not be ready to go home , then rehabilitation consult will be placed to go to "acute rehabilitation unit" if patient is able to participate at least in 3 hours daily, subacute rehabilitation, ventilator rehabilitation, nursing home according to the what the patient needs and insurance availability. The incision should be healed in two weeks and pain medications are being weaned off. Once stable, patient may attend outpatient physical and occupational therapy and allowed for gradual return to daily activity and graduation to work.

BILLING AND CODING

Most patient insurance companies require that the patient and each facility call and request insurance approval for the coming neurosurgical procedures. Each neurological condition carries specific code nationwide as well as surgical code (s). Through these standard codes, the insurance company will match the diagnosis with the presumed procedure and give confirmation number to go ahead to the surgeon and the hospital. After the surgery and hospital care, the business offices of the hospital and the neurosurgeon will send itemized billing of the detailed operative and postoperative reports requesting full reimbursement of the services provided. The final payment after much adjustment will be sent to each service and patient will access a copy of these payments for confirmation.

ESSENTIALS FOR RECOVERY

Faith can take you all the way to recovery, keep you steadfast.

Patient will want to get better, with no secondary gain and being honest with what is about to go forward, doing what he can with what is in his or her control, to be better patient

Be educated and well informed of medical terms, diseases and options. There is no excuse for not being well informed or not educating yourself.

Compliance to "plan of care"

In fact, in my experience, the best outcome and recovery takes place when there is committed highly educated and skilled family member with strong positive attitude.

Always have a positive attitude even if things look dismal.

It is never over until it is over. Even if you wake up paralyzed or cannot talk, remember things change and miracles occur

Be careful of percentages, you may be told that less than 10% chance to live, remember the patient may be in the 10%- why take a chance. There is no text book for each patient, because each patient is different

Quality of life issue is not a reason to terminate life, many patients realized later on after they made decision on quality of life and changed their mind when faced with life or death decision that living with neurological disability is better than death. Patients also have made recovery and are happy to be alive after receiving what others not long ago considered "overly aggressive care"

HOW A PATIENT SEARCH FOR THE RIGHT ANSWER FOR THEIR CARE

Over the years, a list of points developed based on some patients sharing their methodology but also my observation.

- TELL THE PHYSICIAN EVERYTHING ABOUT YOUR COMPLAINTS EVEN IF TRIVIAL
- KEEP DIARY, LOG IN FOR YOUR COMPLAINTS AND PROGRESS
- ALWAYS KEEP A TYPED MEDICATION LIST AND ALLERGIES

- KEEP A TYPED LIST OF ALL THE SURGICAL AND ILLNESS EVENTS OVER THE YEARS
- BE WELL INFORMED WITH MEDICAL RECOMMENDATION AND EXPECTATION GIVEN TO YOU
- IT IS OK AND APPROPRIATE TO ASK QUESTIONS AND REPEAT TO WHAT YOU WERE TOLD
- IT IS APPROPRIATE TO QUESTION THE PHYSICIAN OR THE NURSE
- IT IS OK TO ASK WHAT THE MEDICATION BEING ADMINISTERED TO YOU IS OR THE TREATMENT YOU RECEIVE.
- LOOK AT YOUR LABORATORY VALUES AND REVIEW THE ACTUAL DIAGNOSTIC FILMS WITH YOUR PHYSICIANS SUCH AS X-RAY OF THE CHEST, CTSCAN OF THE BRAIN---
- KEEP LOG FOR ALL YOUR LABORATORY VALUES AND DIAGNOSTIC TESTS AND RESULTS
- IT IS OK TO REPEAT, REPITITION IS GOOD
- KEEP NOTES FROM EACH MEDICAL VISIT AND SHARE WITH YOUR PHYSICIANS
- DO NOT ASSUME THAT THE PHYSICIAN OR NURSE KNOWS EVERYTHING ABOUT YOU
- WHEN YOU CALL GIVE DETAILED PICTURE OF THE PROBLEM AND CIRCUMSTANCES AND DO NOT BE CONCISE AND COVER PART OF IT
- MEDICAL DECISIONS ARE ALSO CARRIED OUT BASED ON WHAT THE PATIENT COMPLAINT IS AND WHAT THE PATIENT SAYS. NOT EVERYTHING CAN BE SEEN IN A MEDICAL TEST OR X-RAY
- COVER ALL THE BASES, WHAT IF EVERYTHING WENT GOOD OR WENT DIFFERENT DIRECTION
- BE INSTRUMENTAL FOR EACH OF YOUR STEPS
- PREPARE FOR THE WORST
- ASK FOR WRITTEN EDUCATION MATERIALS
- AN ILLNESS SHOULD HAVE A CAUSE, MANIFESTATION, TREATMENT OPTIONS AND OUTLOOK (PROGNOSIS)
- SEEK FOR THE ILLNESS PREVENTION, IF IT MAY OCCUR, HOW TO BE PROACTIVE AND IF IT OCCURS HOW TO CARE FOR IT PROMPTLY.

- LEARN MORE ABOUT YOUR ILLNESS, GOOGLE, MEDICAL WEBSITES, ASK THE CARING PHYSICIANS, NURSES AND FAMILY MEMBERS
- TALK TO OTHER PATIENTS
- SHARE OTHERS OPINIONS WITH THOSE WHO ARE TRUSTWORTHY
- SEARCH OTHER SUPPORT GROUPS AND SOCIETIES OF YOUR ILLNESS
- SEEK ILLNESS SPECIFIC CLINICS
- SEARCH FOR OTHER OPINIONS.
- MAKE YOUR FINAL OPINION BASED ON A WELL INFORMED DECISION
- EVERY DECISION HAS RISKS AND BENEFITS, NOTHING IS RISK FREE
- BE COMFORTABLE WITHIN YOURSELF WITH THE PHYSICIAN, THE CARE TEAM AND THE FACILITY

WHAT PATIENT DOES LIKE TO SEE IN A PHYSICIAN AND A NURSE?

"Patient comes first"

"***Treat the patient as you treat yourself"***

"Wait and Listen"

"Do not let your eyes fall asleep until you are certain you have done everything to your patient"

"An ounce of prevention is worth a pound of cure"

"Instead of cursing the darkness, light a candle"

- It was my first and everlasting advice from my Lord Jesus Christ and my neurosurgery mentor, Dr. James Ausman, MD, Ph.D, "Patient comes first". It was back in 1990 when I was told, in my first day of my training in neurosurgery. It is what our Lord Jesus Christ asks of us to do to our fellow patients.
- "Treat the patient as you treat yourself", was the second advice from my Lord Jesus and my mentor, Dr James Ausman.

- "Do not let your eyes fall asleep until you are certain you have done everything to your patient" It was the third advice from my Lord Jesus and Mentor, Dr James Ausman
- Patient want to be heard to the end. I always tell myself while patient is explaining their complaint; "Wait and listen"
- Be humble and "down to the earth" when you treat your patient, "leave your pride"
- Admit mistakes, concerns and limitations
- Ask for additional opinions and second hand if needed
- Be on the top of things and be proactive and prevent
- Be specific
- A well informed patient facilitates many challenges
- It is OK to let the patient know the good and bad
- Some of the helping questions that I often ask myself when I care of a patient:
  "What else I can do?"
  "What can it be? What if the diagnosis was wrong?
  "Who else can be of help to my patient?"
- Be compassionate
- Openness, honesty and sincerity with patient and family during the entire the illness and surgical journey.
- Patient and family education is "a win-win" and the time is well worth it.
- Sharing all the details with patient and family
- Get patient and family involved, early on, in the decision –making process
- Keep continuity of care and do not hand someone else the responsibility
- Fragmentation of care is one of the biggest enemy of quality care

PERSONAL EXPERIENCE

"***HIPPA regulation does not prevent patient access to his records and treatment. Evidence-basde practices do not prevent choosing the best care for the patient."***

Over the years, I have observed many changes; enforce what works and delete what did not work.

- Prevention (measures to avoid illness or deterioration) saying "An ounce of prevention is worth a pound of cure"

- Proactive (think ahead and be ready for things that may happen)
- Prompt (if it happens act immediately without delay)
- Patient-empowered care
- Learn and expand the medical knowledge of various illnesses, symptoms, signs, diagnostic testings and treatment options
- Seek treatment early before is too late knowing that the nervous system is non forgiving if minutes pass by
- Well informative plan of care
- Patient total understanding and full involvement day by day as well as the overall plan of care
- Patient education and awareness of each step and options
- Family participation has an integral role in the caring of the patient
- Daily diary for the events of the day and plan of care and issues
- Address issues in a timely fashion and seek answers
- Medical education on-line and well-known medical references utilized
- HIPPA regulation does not prevent patient to get access to his records and treatment
- Evidence-based practices does not prevent choosing the best care for the patient
- Positive attitude even if dismal
- Additional medical opinions
- Encourage consulting subspecialties
- When condition is not straight forward consider early on higher level of care, tertiary care and university settings
- Instead of cursing, light a candle

  We encourage patient to ask their family to participate in the care from day 1

HEALTHCARE SYSTEM

"Civilized society is that which offer healthcare to its citizen and citizens of the world"

A quality healthcare system is a mark of humanity and sound civility. There are four disciplines that are not for money: healthcare, education, military and spiritual services. They have things in common including service, nobility. The Bible taught us the ideal healthcare providers in the story of the "Good Samaritan". It is a system of men serving their fellow men, the government to

their people. Prosperity and wealth come in many indirect ways and other avenues. There is no excuse to prevent providing healthcare to people. A healthy people are a sign of a wealthy and caring country. Civilized society is that which offers healthcare to its citizens and citizens of the world. For that reason, third world countries are measured for their quality healthcare and reflected by mortality and morbidity and spread of preventable illness. Healthcare topics should not be decided or discussed by politicians or for profit entities.

Early on, medicine was focused on new discoveries and finding cures. Only when business school found stability, need and profitability in medicine industry things became eccentric from the medical mission. There are many misuses and abuses that have nothing to do with patients' care. I guess more than 11,000 claim cases will pay more than $300,000. per case and $3billion spent on lawsuits per year. Ongoing discussion is extensive about what is the ideal healthcare, national healthcare, government operated, private healthcare and many others.

IT IS NOT SHORTAGE OF MONEY, IT IS SHORTAGE OF QUALITY PERSONNEL!

There are many patients who have adequate health insurance coverage and receive poor care. It is the shortage of quality individuals who deliver the care. A good insurance cannot replace a caring medical team and facility.

Commitment is becoming an issue. Healthcare personnel are seeking life style similar to the regular professions. With dedication and commitment, excellence comes. Fragmented care and not being well informed and knowledgable is the main disadvantage of non-committed medical personnel. For commitment, love of the profession and understanding is the key. These points need to be emphasized early on in the career choice so that a set of expectations will be implemented. Then, individuals make decisions based in a well informed environment according to their priorities. Saying that should be part of the selection criteria to medical school and nursing school.

Everyone in the healthcare facility should work under the same medical oath and responsibility of the patient being first and being the **Good Samaritan**. Many individuals working inside the hospitals are not part of the medical team by education or oath or commitment, yet they control a big part of the healthcare delivery.

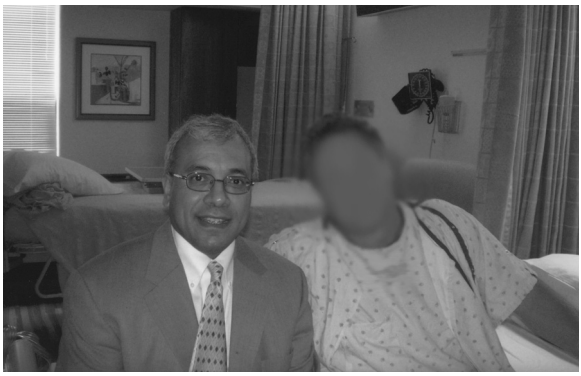
Some of the suggested features include:

1- Medical operated system with common mission statement umbrella
2- Competitive customer service with high incentive toward quality care

3- Competitive research with continuum commitment to new discovery
4- Buy in from public with choices
5- Affordable to all
6- Quality care to all
7- Patient focused care
8- Tailor to individual care needs
9- Healthcare equity in all States
10- Fee for service and compensation fair to labor, quality, liability and education
11- Incentives and reimbursement based on quality and good outcome
12- Healthcare providers embracing the model of "Good Samaritan"
13- Healthcare industry is not the place for politics or profitability
14- No room for business personnel
15- Save lives and strive for best to all
16- Base on State of-the- art delivery of care
17- Care timely with ensuring all options
18- Support ongoing research to promote new discoveries and to prevent and cure illnesses
19- Allow competition
20- Non- for- profit
21- Choice to all
22- Encourage patient to act responsibly , buy in
23- Subsidies to patients who seek healthy life style
24- Reward for healthy life style and well being
25- Support measures against Preventable illness
26- Stops abuse of the system and spending e.g. repeated ED visits
27- Neutral and national arbitration to examine and control healthcare litigious claims and compensation
28- Special assistance and recognition to advanced age, disabled, uninsured and to the sick regardless of any status
29- Insurance and healthcare supply industries regulation and pricing control
30- Reinforcement of healthcare regulation
31- Prevention across all levels and layers abuse, use and misuse

EHM, as a patient recovers from surgery, the recovery room has monitors and she was attended by a nurse who routinely records "vital signs", heart rate, blood pressure respiration, oxygen saturation and temperature. Then the patient is allowed to eat and drink soft materials and ambulate to the chair. The pain is controlled first by intravenous "pain killers", then by mouth pills. Instructions are handed over by the nurse with explanation about her care plans and follow up appointments with the surgeon. She will then accompany with a family member to go home. It is then followed by phone calls to ensure safe arrival. Sometimes home health nursing and therapy will visit her at home until her next appointment with the surgeon.

JM, what a great walk when a patient and his neurosurgeon walk after rounds in the morning and recovered from lengthy neck spine surgery. The neck collar in place, the hospital hallway is long and comfortable for a walk make of carpet. "Going over things" was the discussion between the patient and his neurosurgeon. All patients are allowed to wear hospital gowns, and ID (identification) band around their wrist. The patient has been in his bed and room after the surgery for the entire night. Gradually, the activity was being advanced; allowing his head to gradually be put up, sitting up, and then taking a few steps, to then walking while being supervised. Look how much energy the patient had. JM was looking at his surgery and recovery with faith, hope and courage. He was with such a faith and love that carried him through the illness journey and he looked at all of that as seconds.



A patient is recovering in a hospital room with a hospital gown the day after spinal surgery. Please see the faith, hope and courage in his face and looking forward for tomorrow. KS is walking, with the intravenous fluid pole, in the hospital ward hallway the day after her spinal surgery where a large extruded disc fragment was removed and had caused a year of severe "sciatica" involving leg pain, numbness and tingling. She is recovering with no sciatica but only incision low back pain. "Keep going and stay active", walking, breathing exercises and many more under directions are essential after surgery to keep circulation going and prevent complications. Sedation is kept to moderation in order not to deprive the patient from being "sleepy" all the time and inactive.

A hospital room, quiet almost gives you the feeling of being home. The bed is connected with alarms and monitors. The rails have buttons to change

parts of the bed, the head moves up and down, as well as the foot part. The mattress gets firmer and softer to prevent skin sores, light strong and weak centered in patient needs. The button key is accessible for patients to turn on and off the light, to call for nurses or assistance, to alarm the nurse if the patient starts to move. There is also a feature called "telemetry" where the patient is connected to an EKG, respiration andO2 saturation by electrodes and monitored in a center station. Therefore, while the patient is recovering in a quiet, homey room, his heart, respiration and breathing is monitored quietly. The patient is usually connected to an intravenous pole to administer fluids for hydration and medications to be administered for pain, nausea and other reasons as ordered. This patient had surgery a day before after passing through the recovery care unit and found to be stable to go to the regular hospital room.

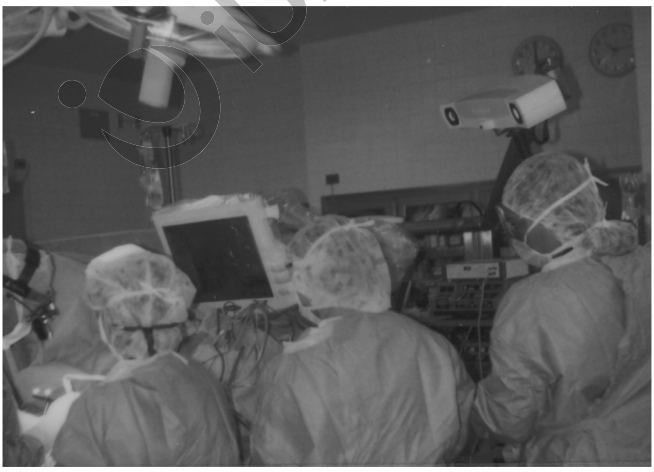
The neurosurgeon during surgery puts on magnified surgical loops and illumination in order to facilitate seeing the tiny nervous structures involving the brain and nerves. The neurosurgeon works with a team of nurses consisting of; circulating nurse(a handy nurse supervises and hands out things that are needed and confirms things during surgery), a scrub nurse(the primary surgical nurse who hands the surgeon the instruments, one by one, step by step, collect and being in charge of set up and handle), a surgical technician (concentrates in handling instruments to the surgeon and set up), an assistant (helps the surgeon and assists during surgery), a neurosurgery lead nurse(nurse in charge of the neurosurgery nursing team and needs. The MRI and x-rays of the patient is seen in the back so that the surgeon will be able to refer to them during surgery while attempting to remove whatever it is that needs to be removed.

A close-up photo of a neurosurgeon's preparation prior to surgery.

Missing Image
IMAGE 62

A close look at the neurosurgeon while operating. The neurosurgeon looks at the surgical magnifying loops for the close up nervous structure. He also looks at the periphery through the eyeglass lenses for the periphery. Please note the strength of the head light around the neurosurgeon's head.

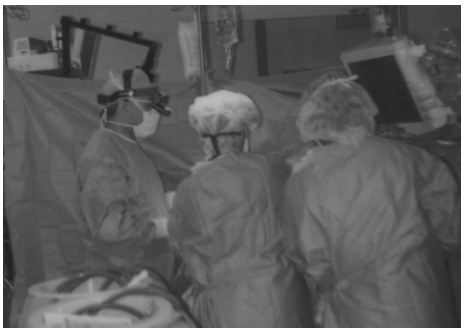
It is a team approach, the operating room personnel like one family working hand in hand to serve the patient and get the job done. This photo was taken at the end of a surgery when the job was done well and the mission was accomplished and the patient was about to recover after dressing the surgical site. Please note the sterility and "masks, gowns, gloves, hats"; everyone is covered with restrict sterility to prevent infection.



During spine surgery, the patient is laying prone (on his stomach) on a special frame, the arc like structure is an x-ray machine called C-Arm to guide the surgeon seeing the spine, identify the level and structure and help placing the screws in the right place. There are a wide variety of instruments that are

sterile and arranged neatly on the overhead table. Please note the scrub nurse and assistant. The personnel is covered by surgical hate, face mask and wear sterile gowns and gloves. The field is covered by sterile drapes and beyond the drapes toward the head of the patient is the anesthesiologist monitoring the patient and administering anesthesia. The operating room is quiet, sacred and everyone is concentrating on the patient and the job to be done.

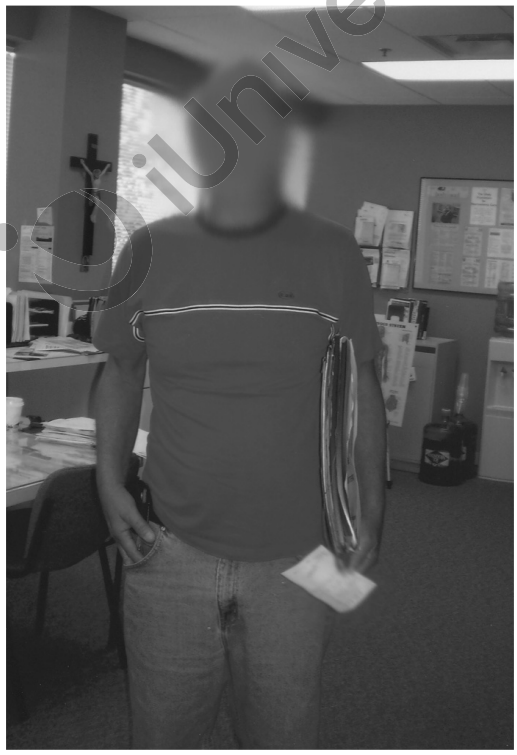
A close look at the arrangement of some of the surgical instruments on an overhead table placed on the side neatly. There are usually three long and large tables set up for an average case. In addition, there are other equipment used such as electro- coagulation operated device to stop the bleeding, suction to keep the field dry of blood and secretion, ultrasound to visualize the surgery site by ultrasound waves, aspiration tools to aspirate the pathology tissue, microscope to magnify the field and provide stronger illumination more than the head loops and light. The patient is grounded. These instruments are heavy metal and fine to do the job. They have a firm hand grip into them and pointed to the job. Each step of the surgery will require it's own instruments. There are many surgical instruments and are made by many medical and surgical equipment companies under strict rules and regulations. After each case, they are counted and sent for sterilization after cleaning them. Sterilization takes about 24 hours in a "central supply" section of the hospital. Many workers are performing an outstanding job in this section. It is part of the surgery service.



A brain surgery is being performed; the neurosurgeon, the assistant and the scrub nurse surround the surgical field. A large microscope is not seen but the image guided system is seen where it helps the surgeon to localize the tumor inside the brain of the patient and facilitate the complete tumor removal with the shortest access, the window of the image guided system is seen. Also, there is a strong drill on the side where it cuts the skull and bone in a fine way to reach the brain. After surgery is completed in the brain, the bone is placed back by micro screws and plates.

The brain surgery is going on and the neurosurgeon is holding the ultrasound probe to visualize the structure through the brain using the ultrasound waves. The microscope is sterile and draped waiting for the neurosurgeon to use. The Midas drill, to drill the one away, is placed in the container, the bone work is done for now. The brain surgery is progressing. At this stage the image guided system is being adjusted to the reference marks in the patient's head. These marks are placed prior to the surgery during the MRI. The camera is looking at these marks and hence orients itself to the patient's head in the space and the neurosurgeon is able to localize the brain tumor inside the brain

and prevent him from going to a lengthy or wrong track in the brain since every part of the brain is essential.



Office and clinic, neurosurgeon clinic and office is the first place the patient visits when they come in for an evaluation and preparation for surgery. It is also the place where they will come back for follow up after surgery once discharged from the hospital. This is where the patients comes in, complete forms and discuss the case; the films are reviewed of the brain and spine. The clinic has handy parking and well illuminated ramp to the office. Once the patient is evaluated and decisions have been made for follow up appointments or they schedule the necessary surgery. Inside the office, there is a display about neurosurgery, the brain and spine and peripheral nerves, neurosurgeon qualifications and achievements, patients' quotes and what is written about his care. The personal side of the neurosurgeon can ease some of the questions that patients may have about the physician. The films, MRI, CT scan and x-rays are reviewed both in the illuminated fluorescence view box and on the computer screen. Inside the clinic, minor surgical instruments are present such as dressing changes, and suture removal kits, in addition to the routine vital signs equipment and weight measurement. Over the years, it has been our observation that the patient and family want to know as much information as they can about their neurosurgeon, medical, faith, social and some personal. The patient wishes to be close to the neurosurgeon and ultimately a tie of friendship. Despite some of the concerns to display neutral pictures, no one patient became offended from a physician displaying his faith and some of his true caring stories. Other patients' quotes are also powerful in connecting patients together and with physicians.