NEUROLOGICAL AND SPINAL ASSESSMENT

EVIDENCE BASED BEST PRACTICES

NURSING PRACTICE



INITIAL ASSESSMENT-COMPREHENSIVE EXAM

- SHOULD COVER THE FOLLOWING CRITICAL AREAS:
 - LEVEL OF CONSCIOUSNESS AND MENTATION
 - MOVEMENT
 - SENSATION
 - CEREBELLAR FUNCTION
 - REFLEXES
 - CRANIAL NERVES
- THIS INITIAL EXAM WILL ESTABLISH BASELINE DATA WITH WHICH TO COMPARE SUBSEQUENT ASSESSMENT FINDINGS



THE SINGLE MOST IMPORTANT ASSESSMENT-LEVEL OF CONSCIOUSNESS (LOC) & MENTATION

- A CHANGE IN EITHER IS USUALLY FIRST CLUE TO DETERIORATING CONDITION
 - HELPS TO BE FAMILIAR WITH TERMINOLOGY USED TO DESCRIBE LOC
- **FULL CONSCIOUSNESS P**ATIENT IS **ALERT, ATTENTIVE**, AND **FOLLOWS COMMANDS**. IF ASLEEP, RESPONDS PROMPTLY TO EXTERNAL STIMULATION AND, ONCE AWAKE, REMAINS ATTENTIVE.
- LETHARGIC- PATIENT IS DROWSY BUT AWAKENS—ALTHOUGH NOT FULLY—TO STIMULATION. WILL ANSWER QUESTIONS AND FOLLOW COMMANDS, BUT SLOWLY AND INATTENTIVELY.
- <u>OBTUNDED-</u> PATIENT IS DIFFICULT TO AROUSE AND NEEDS CONSTANT STIMULATION IN ORDER TO FOLLOW A SIMPLE COMMAND. MAY RESPOND VERBALLY WITH ONE OR TWO WORDS, BUT WILL DRIFT BACK TO SLEEP BETWEEN STIMULATION.
- <u>STUPOROUS-</u> PATIENT AROUSES TO VIGOROUS AND CONTINUOUS STIMULATION; TYPICALLY, A PAINFUL STIMULUS IS REQUIRED. MAY MOAN BRIEFLY BUT DOES NOT FOLLOW COMMANDS. ONLY RESPONSE MAY BE AN ATTEMPT TO WITHDRAW FROM OR REMOVE THE PAINFUL STIMULUS.
- <u>COMATOSE-</u> PATIENT DOES NOT RESPOND TO CONTINUOUS OR PAINFUL STIMULATION. DOES NOT MOVE—EXCEPT, POSSIBLY, REFLEXIVELY—AND DOES NOT MAKE ANY VERBAL SOUNDS.

GLASGOW COMA SCALE

- BASED ON 3 PATIENT RESPONSES:
 - EYE OPENING
 - MOTOR RESPONSE
 - VERBAL RESPONSE
- PATIENT RECEIVES SCORE FOR BEST RESPONSE IN EACH OF THESE AREAS (SCORE IS ADDED TOGETHER).
 - SCORE RANGE FROM 3-15.
 - HIGHER THE NUMBER, THE BETTER.
 - <8 USUALLY INDICATES COMA.

TABLE

Test	Score	Patient's response	
EYE OPENING			
Spontaneously	4	Opens eyes spontaneously	
To speech	3	Opens eyes to verbal command	
To pain	2	Opens eyes to painful stimulus	
None	1	Doesn't open eyes in response to stimulus	
MOTOR RESPONSE			
Obeys	6	Reacts to verbal command	
Localizes	5	Identifies localized pain	
Withdraws	4	Flexes and withdraws from painful stimulus	
Abnormal flexion	3	Assumes a decorticate position	
Abnormal extension	2	Assumes a decerebrate position	
None	1	No response; lies flaccid	
VERBAL RESPONSE			
Oriented	5	Is oriented and converses	
Confused	4	Is disoriented and confused	
Inappropriate words	3	Replies randomly with incorrect words	
Incomprehensible	2	Moans or screams	
None	NURS	INO response IN CREDIBLY EASY	

SIMPLIFYING NEUROLOGIC ASSESSMENT

RANK, WENDI

NURSING MADE INCREDIBLY EASY8(2):15-19, MARCH-APRIL 2010.

DOI: 10.1097/01.NME.0000368746.06677.7C

MENTATION

- IF PATIENT IS ALERT OR AWAKE ENOUGH TO ANSWER QUESTIONS, YOU WILL ASSESS MENTATION BY ASKING THE FOLLOWING QUESTIONS TO DETERMINE ORIENTATION TO PERSON, PLACE, AND TIME:
 - WHAT IS YOUR NAME?
 - WHERE ARE YOU RIGHT NOW?
 - WHY ARE YOU HERE?
 - WHAT YEAR IS IT?
 - WHO IS THE PRESIDENT?

•	•	•			
1 mm	2 mm	3 mm	4 mm	5 mm	6 mm

PUPILS

- ASSESSMENT OF PUPILS IS ESPECIALLY IMPORTANT IN A PATIENT WITH IMPAIRED LOC.
- SIMILAR TO CHANGE IN LOC, CHANGE IN PUPIL SIZE, SHAPE, OR REACTIVITY CAN INDICATE INCREASING INTRACRANIAL PRESSURE (ICP) FROM A MASS OR FLUID.
 - PUPILS WILL BE COVERED AS PART OF CRANIAL NERVE ASSESSMENT



ASSESSING FOR SIGNS OF MOTOR DYSFUNCTION

• PATIENT MUST BE AWAKE, WILLING TO COOPERATE, & ABLE TO UNDERSTAND WHAT YOU ARE ASKING

- WITH PATIENT IN BED, ASSESS MOTOR STRENGTH BILATERALLY. HAVE THE PATIENT:
 - FLEX AND EXTEND ARMS AGAINST YOUR HAND
 - SQUEEZE YOUR FINGERS
 - LIFT LEG WHILE YOU PRESS DOWN ON THIGH
 - HOLD LEG STRAIGHT AND LIFT AGAINST GRAVITY
 - FLEX AND EXTEND FOOT AGAINST YOUR HAND
- UPPER EXTREMITIES: BICEPS MUSCLE/ MUSCULOCUTANEOUS NERVE, TRICEPS/ RADIAL NERVE, MEDIAN AND ULNAR NERVES, RADIAL NERVE, MEDIAN AND ULNAR NERVES
- LOWER EXTREMITIES: ILIOPSOAS MUSCLE/FEMORAL NERVE, HAMSTRINGS/SCIATIC NERVE, QUADRICEPS/FEMORAL NERVE, PERONEAL NERVE, TIBIAL NERVE

MUSCLE STRENGTH IS GRADED 0-5

- 0 = NO CONTRACTION
- 1 = BARELY DETECTABLE FLICKER OR TRACE OF CONTRACTION
- 2 = ACTIVE MOVEMENT WITH GRAVITY ELIMINATED (HORIZONTAL MOTION IS SEEN)
- 3 = ACTIVE MOVEMENT AGAINST GRAVITY
- 4 = ACTIVE MOVEMENT AGAINST GRAVITY AND SOME RESISTANCE
- 5 = ACTIVE MOVEMENT AGAINST FULL RESISTANCE THIS IS NORMAL.
- EXAMINER ALWAYS COMPARES PATIENT'S RIGHT SIDE TO LEFT SIDE AND SHOULD DETECT SYMMETRY; PATIENT'S DOMINANT SIDE MAY BE SLIGHTLY STRONGER.

INSPECTION AND PALPATION: MUSCLE STRENGTH

MUSCLE STRENGTH SHOULD BE EQUAL BILATERALLY.

- WHEN TESTING MUSCLE STRENGTH IN THE ARMS ASK YOUR PATIENT TO DO THE FOLLOWING AGAINST RESISTANCE:
- LIFT ARMS AWAY FROM SIDE
- PUSH ARMS TOWARDS SIDE
- PULL FOREARM TOWARDS UPPER ARM
- PUSH FOREARM AWAY FROM UPPER ARM
- • LIFT WRIST UP; PUSH WRIST DOWN
- SQUEEZE EXAMINERS FINGER
- • PULL FINGERS APART
- • SQUEEZE FINGERS TOGETHER

INSPECTION AND PALPATION: MUSCLE TONE

- WHEN TESTING MUSCLE STRENGTH IN THE LEGS ASK YOUR PATIENT TO DO THE FOLLOWING AGAINST RESISTANCE:
- • LIFT LEGS UP
- PUSH LEGS DOWN
- • PULL LEGS APART
- • PUSH LEGS TOGETHER
- PULL LOWER LEG TOWARDS UPPER LEG
- • PUSH LOWER LEG AWAY FROM UPPER LEG
- • PUSH FEET AWAY FROM LEGS
- • PULL FEET TOWARDS LEGS



- ABNORMAL MUSCLE TONE FINDINGS CAN INCLUDE:
- LIMITED RANGE OF MOTION
- PAIN ON MOTION
- • DECREASED RESISTANCE (FLACCIDITY) OR INCREASED RESISTANCE (RIGIDITY), OR SPASTICITY

ASSESSING FOR SIGNS OF MOTOR DYSFUNCTION- UNCONSCIOUS PATIENT

- ASSESS MOTOR RESPONSE IN UNCONSCIOUS PATIENT BY APPLYING A NOXIOUS STIMULUS AND OBSERVING PATIENT'S RESPONSE.
- ANOTHER APPROACH IS CENTRAL STIMULATION, SUCH AS STERNAL PRESSURE-
 - PRODUCES AN OVERALL BODY RESPONSE
 - MORE RELIABLE THAN PERIPHERAL STIMULATION
 - MHAš-
 - IN AN UNCONSCIOUS PATIENT, PERIPHERAL STIMULATION, SUCH AS NAILBED PRESSURE, CAN ELICIT A REFLEX RESPONSE, WHICH IS NOT A TRUE INDICATOR OF MOTOR ACTIVITY.

EVALUATING SENSATION

- PATIENT MUST BE ABLE TO COOPERATE WITH THE EXAM. WILL NEED TO TELL YOU WHETHER THE SENSATION IS FELT AND WHETHER IT IS FELT ON BOTH SIDES OF BODY EQUALLY.
 - BEGIN WITH THE FEET AND MOVE UP THE BODY TO THE FACE, COMPARING ONE SIDE WITH THE OTHER. ASSESS SENSATION TO LIGHT TOUCH USING YOUR FINGERTIPS OR COTTON.
 - TEST SUPERFICIAL PAIN SENSATION WITH A CLEAN, UNUSED SAFETY PIN. ALSO, TEST SENSATION USING A DULL OBJECT. THE PATIENT SHOULD BE ABLE TO DISTINGUISH SHARP FROM DULL.
 - TEST PROPRIOCEPTION, OR POSITION SENSE, BY MOVING THE PATIENT'S TOES AND FINGERS UP OR DOWN. GRASP THE DIGIT BY ITS SIDES AND HAVE THE PATIENT TELL YOU WHICH WAY IT'S POINTING.

EVALUATING CEREBELLAR FUNCTION

- TEST IF INDICATED, HOWEVER, TESTING CEREBELLAR FUNCTION MAY NOT BE NECESSARY IN A PROBLEM-FOCUSED EXAM, AND CANNOT BE PERFORMED IF PATIENT CAN'T, OR WON'T, FOLLOW COMMANDS.
- UPPER EXTREMITIES
 - IF PATIENT IS IN BED, HOLD UP YOUR FINGER AND HAVE PATIENT QUICKLY AND REPEATEDLY MOVE HIS FINGER BACK AND FORTH FROM YOUR FINGER TO HIS NOSE.
 - THEN HAVE PATIENT ALTERNATELY TOUCH THEIR NOSE WITH THEIR RIGHT AND LEFT INDEX FINGERS.
 - FINALLY, HAVE PATIENT REPEAT THESE TASKS WITH THEIR EYES CLOSED. MOVEMENTS SHOULD BE PRECISE AND SMOOTH.

ASSESSMENT OF THE SENSORY SYSTEM

- TESTING THE SENSORY SYSTEM CHECKS THE INTACTNESS OF PERIPHERAL NERVES, SENSORY TRACTS, AND HIGHER CORTICAL DISCRIMINATION.
- HAVE YOUR PATIENT CLOSE HIS EYES WHILE CHECKING SENSORY PERCEPTION.
- LIGHT TOUCH: CAN YOUR PATIENT FEEL LIGHT TOUCH EQUALLY ON BOTH SIDES OF THE BODY?
- SHARP/DULL: CAN YOUR PATIENT DISTINGUISH BETWEEN A SHARP OR DULL OBJECT ON BOTH SIDES OF THE BODY?
- HOT/COLD: CAN YOUR PATIENT DISTINGUISH BETWEEN A HOT OR COLD OBJECT ON BOTH SIDES OF THE BODY? (JARVIS, 2011; SHAW, 2012).

SENSORY

- CORTICAL SENSATIONS SHOULD BE TESTED WHENEVER A PARIETAL LESION IS SUSPECTED FROM THE SCREENING EXAMINATION OR
 PATIENT HISTORY. THESE ADDITIONAL TESTS INCLUDE:
- DINUMBER IDENTIFICATION (GRAPHESTHESIA). EXAMINER TRACES A NUMBER IN PATIENT'S PALM WITH PATIENT'S EYE CLOSED AND ASKS THE PATIENT TO IDENTIFY THE NUMBER. REPEAT IN THE OTHER PALM.
- DOUBLE SIMULTANEOUS STIMULATION. EXAMINER TOUCHES THE PATIENT IN LUE, THEN RUE, THEN BOTH UE SIMULTANEOUSLY WHILE THE PATIENT'S EYES ARE CLOSED. ASK THE PATIENT. WHERE THEY FEEL THE TOUCH.
- TWO POINT DISCRIMINATION. EXAMINER CAN USE SPECIAL CALIBERS OR OPEN UP A PAPER CLIP FOR THIS MANEUVER.
- STEREOGNOSIS. THIS TESTS OBJECT RECOGNITION WITHOUT THE USE OF VISION. ASK THE PATIENT TO CLOSE THEIR EYES, THEN EXAMINER PLACES A FAMILIAR OBJECT IN THE PATIENTS PALM (I.E., A COIN, KEY, PAPER CLIP) AND ASKS THEM TO IDENTIFY THE OBJECT BY TOUCH.
- WHENEVER A SPINAL CORD LESION IS SUSPECTED, TESTING FOR LIGHT TOUCH AND PAIN SENSATION (PERHAPS EVEN TEMPERATURE SENSE) SHOULD BE THOROUGHLY DONE OVER THE TRUNK AND SACRAL AREAS AS WELL AS THE LIMBS. A REPLICABLE LEVEL OF SENSORY LOSS AT A DERMATOMAL LEVEL IS A SIGNIFICANT FINDING. RECTAL TONE SHOULD ALSO BE CHECKED HERE.

ASSESSING THE SPINOTHALAMIC TRACT

- CHECKING THE SPINOTHALAMIC TRACT TESTS YOUR PATIENT'S ABILITY TO SENSE PAIN, TEMPERATURE, AND LIGHT TOUCH.
- PRESENCE OF PAIN: PAIN CAN BE TESTED BY A SIMPLE PIN PRICK WITH THE PATIENT'S EYES CLOSED. ABNORMAL FINDINGS WOULD
- INCLUDE HYPALGESIA, HYPOALGESIA, AND ANALGESIA.
- TEMPERATURE: TEMPERATURE SHOULD BE TESTED ONLY IF PAIN TEST IS NORMAL. HOT AND COLD OBJECTS MAY BE PLACED ON THE
- PATIENT'S SKIN AT VARIOUS LOCATIONS BILATERALLY TO TEST FOR TEMPERATURE SENSATION.
- LIGHT TOUCH: WITH A COTTON BALL OR SOFT SIDE OF A Q-TIP, TOUCH THE PATIENT'S BODY BILATERALLY WITH THEIR EYES CLOSED. ASK
- THEM TO INDICATE WHEN YOU HAVE TOUCHED THEM. ABNORMAL RESPONSES INCLUDE HYPOESTHESIA, ANESTHESIA, AND
- HYPERESTHESIA.

ASSESSING THE POSTERIOR COLUMN TRACT

- ASSESSING THE POSTERIOR COLUMN TRACT MAY IDENTIFY LESIONS OF THE SENSORY CORTEX OR VERTEBRAL COLUMN.
- VIBRATION: TEST THE PATIENT'S ABILITY TO FEEL VIBRATIONS BY PLACING A TUNING FORK OVER VARIOUS BONEY LOCATIONS ON THE
- PATIENT'S TOES AND FEET. IF THESE AREAS ARE NORMAL, THEN YOU MAY ASSUME THE PROXIMAL AREAS ARE ALSO NORMAL.
- POSITION: POSITION OR KINESTHESIA IS TESTED BY HAVING THE PATIENT CLOSE THEIR EYES AND MOVE THEIR BIG TOE UP AND DOWN. THE
- PATIENT SHOULD BE ABLE TO TELL YOU WHICH WAY THEIR TOES ARE MOVING.

ASSESSING THE POSTERIOR COLUMN TRACT

- TACTILE DISCRIMINATION
- TACTILE DISCRIMINATION TESTS THE DISCRIMINATION ABILITY OF THE SENSORY CORTEX. STEREOGNOSIS TESTS THE PATIENT'S ABILITY TO
- RECOGNIZE OBJECTS BY FEELING THEM. YOU CAN PLACE CAR KEYS, A SPOON, A PENCIL, OR OTHER COMMON OBJECT IN YOUR PATIENT'S
- HAND. THEY SHOULD BE ABLE TO IDENTIFY THAT OBJECT BY FEEL ONLY. GRAPHESTHESIA IS THE ABILITY TO "READ" A NUMBER "WRITTEN"
- IN YOUR PALM.
- TWO POINT DISCRIMINATION
- TWO POINT DISCRIMINATION TESTS THE BRAIN'S ABILITY TO DETECT TWO DISTINCT PIN PRICKS ON THE SKIN. AN INCREASE IN THE
 DISTANCE
- IT NORMALLY TAKES TO IDENTIFY TWO DISTINCT PRICKS OCCURS WITH SENSORY CORTEX LESIONS (JARVIS, 2011; SHAW, 2012).

ASSESSING DEEP TENDON REFLEXES

- DEEP TENDON REFLEXES INCLUDE-
 - TRICEPS
 - BICEPS
 - BRACHIORADIALIS
 - PATELLAR
 - ACHILLES TENDON
 - NOT ROUTINELY ASSESSED
- SHOULD BE TESTED IN ANY PATIENT WITH A SPINAL CORD INJURY
- TESTED WITH REFLEX HAMMER.
 - GRADED FROM 0-5+ (0-4)
 - 0- NO REFLEX
 - 1- LOW/DIMINISHED
 - 2+- NORMAL
 - 3+ BRISK
 - 4+ VERY BRISK
 - 5+ HYPERREFLEXIA WITH CLONUS (REPEATED RHYTHMIC CONTRACTIONS)

REFLEXES

• EXAMINER ELICITED THE FOLLOWING DEEP TENDON REFLEXES BILATERALLY AND GRADED WITH 0-4 SCALE:

- 0=ABSENT REFLEX, NO RESPONSE
- 1=DIMINISHED, LOW NORMAL (BROUGHT OUT WITH REINFORCEMENT = JENDRASSIK MANEUVER)
- 2=NORMAL, AVERAGE
- 3=BRISKER THAN AVERAGE, POSSIBLY BUT NOT NECESSARILY INDICATIVE OF DISEASE
- 4=HYPERACTIVE WITH CLONUS
- PATIENT IS SITTING, RELAXED, LIMBS ARE SYMMETRICALLY POSITIONED
- EXAMINER HOLDS REFLEX HAMMER BETWEEN THEIR THUMB AND INDEX FINGER
- EXAMINER SWINGS THE REFLEX HAMMER BRISKLY (QUICK AND DIRECT) USING A RAPID WRIST MOVEMENT
- IF THE REFLEXES APPEAR ASYMMETRICAL, THIS MAY BE DUE TO THE PATIENT'S POOR POSTURE OR TENSENESS. RETEST THE REFLEXES IN THE SUPINE POSITION ON THE EXAMINATION TABLE.
- EXAMINER BILATERALLY TESTED THE FOLLOWING REFLEXES:

DEEP TENDON REFLEXES

- <u>BICEPS-</u> PATIENT'S ARM SHOULD BE FLEXED SLIGHTLY WITH THE PALM FACING UP. HOLD ARM WITH YOUR THUMB IN THE ANTECUBITAL SPACE OVER THE BICEPS TENDON. STRIKE YOUR THUMB WITH THE HAMMER; THE ARM SHOULD FLEX SLIGHTLY.
- <u>TRICEPS-</u> PATIENT'S ARM SHOULD BE FLEXED 90 DEGREES. SUPPORT THE ARM AND STRIKE IT JUST ABOVE THE ELBOW, BETWEEN THE EPICONDYLES; THE ARM SHOULD EXTEND AT THE ELBOW.
- <u>BRACHIORADIALIS</u>- PATIENT'S ARM SHOULD BE FLEXED SLIGHTLY AND RESTING ON THE LAP WITH THE PALM FACING DOWN. STRIKE THE OUTER FOREARM ABOUT TWO INCHES ABOVE THE WRIST; THE PALM SHOULD TURN UPWARD AS THE FOREARM ROTATES LATERALLY.
- <u>PATELLAR-</u> WITH TH PATIENT'S LEGS DANGLING (IF POSSIBLE), PLACE YOUR HAND ON ONE THIGH AND STRIKE THE LEG JUST BELOW THE KNEECAP; THE LEG SHOULD EXTEND AT THE KNEE.
- <u>ACHILLES TENDON-</u> WITH PATIENT'S FOOT IN SLIGHT DORSIFLEXION, LIGHTLY STRIKE THE BACK OF THE ANKLE, JUST ABOVE THE HEEL; THE FOOT SHOULD PLANTAR FLEX.



- BICEPS REFLEX (C5, C6)
- A. PATIENT'S ARMS ARE PARTIALLY FLEXED AT THE ELBOW
- B. EXAMINER PLACES HIS OR HER THUMB OR INDEX FINGER OVER BICEPS TENDON
- C. EXAMINER THEN STRIKES HIS OR HER THUMB/INDEX FINGER

- TRICEPS REFLEX (C7, C8)
- A. FLEX THE PATIENT'S ARM 90 DEGREES AT THE ELBOW, PALM TOWARDS THEIR BODY, PULLED SLIGHTLY ACROSS THE CHEST
- B. EXAMINER DIRECTLY STRIKES TRICEPS TENDON, JUST PROXIMAL TO THE OLECRANON
- OR
- C. EXAMINER POSITIONS AND SUPPORTS THE PATIENT'S ARM SO THAT IT IS HORIZONTAL AND ELBOW IS FLEXED TO 90 DEGREES, WITH THE
 FOREARM HANGING LIMP
- D. EXAMINER DIRECTLY STRIKES TRICEPS TENDON, JUST PROXIMAL TO THE OLECRANON

- BRACHIORADIALIS REFLEX (C5, C6)
- A. PATIENT'S HAND RESTS ON HIS/HER LAP, WITH FOREARM HALFWAY BETWEEN SUPINATION AND PRONATION
- B. EXAMINER STRIKES RADIUS ABOUT 1 TO 2 INCHES PROXIMAL TO THE WRIST TO SEE FOREARM FLEXION AND SUPINATION.
- KNEE REFLEX (L2, L3, L4)
- A. PATIENT IS SITTING SO THAT THE LEGS ARE FREELY DANGLING (PATIENT'S FEET SHOULD NOT BE RESTING ON THE STOOP)
- B. PATIENT'S LEGS SHOULD NOT BE FLUSH AGAINST THE END OF THE EXAM TABLE.
- C. EXAMINER SHOULD STAND TO PATIENT'S SIDE SO AS NOT TO BE HIT BY A BRISK REFLEX!
- D. EXAMINER STRIKES PATELLAR TENDON JUST DISTAL TO PATELLA. (EXAMINER MAY PLACE HIS/HER OTHER HAND ON PATIENT'S DISTAL QUADRICEPS MUSCLE TO FEEL FOR A CONTRACTION AS THEY STRIKE THE TENDON WITH THE REFLEX HAMMER IN THE OTHER HAND.)
- (IF DONE SUPINE, SEE ADDENDUM LATER.)



- ANKLE REFLEX (S1)
- A. WITH THE PATIENT'S LEG STILL DANGLING, EXAMINER GRASPS PATIENT'S FOOT AND SLIGHTLY DORSIFLEXES PATIENT'S FOOT (FOOT SHOULD ABOUT BE PARALLEL TO THE FLOOR)
- B. EXAMINER STRIKES ACHILLES' TENDON AND WATCHES AND FEELS FOR PLANTAR FLEXION.

- EXAMINER TESTED FOR THE PLANTAR RESPONSE (BABINSKI SIGN) ON EACH FOOT.
- A. EXAMINER HOLDS THE PATIENTS HEEL AND STROKES THE LATERAL SIDE OF THE SOLE, BEGINNING AT THE HEEL AND MOVING TO THE BALL OF THE FOOT, CURVING MEDIALLY ACROSS THE BALL.
- B. EXAMINER BEGINS WITH THE LIGHTEST STIMULATION THAT PROVOKES A RESPONSE
- C. PATIENT'S TOES NORMALLY FLEX
- D. A BABINSKI RESPONSE = DORSIFLEXION OF BIG TOE, OFTEN ACCOMPANIED BY FANNING OF THE OTHER TOES.

ASSESSING SUPERFICIAL REFLEXES

- PLANTAR REFLEX IS THE ONLY SUPERFICIAL REFLEX THAT'S COMMONLY ASSESSED AND SHOULD BE TESTED IN COMATOSE PATIENTS, AND THOSE WITH SUSPECTED INJURY TO LUMBAR 5-5 OR SACRAL 1-2 AREAS OF THE SPINAL CORD.
 - STIMULATE THE SOLE OF THE FOOT WITH A TONGUE BLADE OR THE HANDLE OF A REFLEX HAMMER.
 - BEGIN AT THE HEEL & MOVE UP THE FOOT, IN A CONTINUOUS MOTION, ALONG THE OUTER ASPECT OF THE SOLE AND THEN ACROSS THE BALL TO THE BASE OF THE BIG TOE.
- NORMAL RESPONSE IS PLANTAR FLEXION (CURLING UNDER) OF THE TOES.
 - EXTENSION OF THE BIG TOE (BABINSKI'S SIGN) IS ABNORMAL, EXCEPT IN CHILDREN YOUNGER THAN 2 YEARS.



- UPPER ABDOMINAL: IPSILATERAL CONTRACTION OF ABDOMINAL MUSCLES ON THE STROKED SIDE.
- LOWER ABDOMINAL: IPSILATERAL CONTRACTION OF ABDOMINAL MUSCLES ON THE STROKED SIDE.
- **CREMASTERIC:** STROKE INNER THIGH, ELICITS ELEVATION OF TESTES.
- SUPERFICIAL REFLEXES

ASSESSING BRAIN STEM REFLEXES

- ASSESS BRAIN STEM REFLEXES IN STUPOROUS OR COMATOSE PATIENTS TO DETERMINE IF THE BRAIN STEM IS
 INTACT.
 - PROTECTIVE REFLEXES (COUGHING, GAGGING, AND THE CORNEAL RESPONSE) WILL BE PART OF CRANIAL
 NERVE ASSESSMENT.
- OCULOCEPHALIC, OR DOLL'S EYE, REFLEX-
 - TURN PATIENT'S HEAD BRISKLY FROM SIDE TO SIDE- THE EYES SHOULD MOVE TO THE LEFT WHILE HEAD IS TURNED TO THE RIGHT, AND VICE VERSA.
 - IF THIS REFLEX IS ABSENT, THERE WILL BE NO EYE MOVEMENT.
- OCULOVESTIBULAR REFLEX (ICE CALORIC OR COLD CALORIC REFLEX)-
 - A PHYSICIAN WILL INSTILL AT LEAST 20 ML OF ICE WATER INTO PATIENT'S EAR.
 - WITH INTACT BRAIN STEM, EYES WILL MOVE LATERALLY TOWARD AFFECTED EAR.
 - WITH SEVERE BRAIN STEM INJURY, GAZE WILL REMAIN AT MIDLINE.

ASSESSING THE CRANIAL NERVES

- 12 PAIRS OF CRANIAL NERVES
 - SENSORY
 - MOTOR
 - BOTH
- ASSESSMENT OF WHICH NERVES DEPENDS ON PATIENT'S DIAGNOSIS
 - MUST HAVE PATIENT COOPERATION
 - CANNOT PERFORM COMPLETE ASSESSMENT ON COMATOSE PATIENT
- EXTRAOCULAR MOVEMENTS (EOMS) ARE CONTROLLED BY CRANIAL NERVES III, IV, AND VI, WHICH YOU'LL TEST TOGETHER.
- OTHER FUNCTIONS THAT ARE DEPENDENT ON MORE THAN ONE CRANIAL NERVE ARE:
 - PUPILLARY RESPONSE (CN II AND III)
 - CORNEAL REFLEX (CN V AND VII)
 - GAG REFLEX (CN IX AND X).



#	Name	Nerve type	Function
I.	Olfactory	Sensory	Smell
Ш	Optic	Sensory	Vision
Ш	Oculomotor	Motor	Most eye movement
IV	Trochlear	Motor	Moves eye
۷	Trigeminal	Both	Face sensation, mastication
VI	Abducens	Motor	Abducts the eye
VII	Facial	Both	Facial expression, taste
VII	Vestibulocochlea r	Sensory	Hearing, balance
IX	Glossopharyngeal	Both	Taste, gag reflex
X	Vagus	Both	Gag reflex, parasympathetic innervation
XI	Accessory	Motor	Shoulder shrug
XII	Hypoglossal	Motor	Swallowing, speech

CRANIAL NERVES

- THE CRANIAL NERVE ARE ARRANGED IN PAIRS IN DESCENDING ORDER ALONG THE BRAINSTEM.
- THERE ARE 3 SENSORY NERVES (CN I, II AND VIII), 5 MOTOR NERVES (CN III, IV, VI, XI AND XII) AND 4 MIXED MOTOR AND SENSORY NERVES (CN V, VII, IX AND X).
- CRANIAL NERVE DYSFUNCTION PRODUCES IPSILATERAL EFFECTS (SAME SIDE)*
- DALL CRANIAL NERVES CAN BE TESTED IN AN AWAKE AND ALERT PATIENT WHO IS ABLE TO PARTICIPATE IN THE EXAMINATION.
- ONLY SOME OF THE CRANIAL NERVES CAN BE TESTED IN PATIENTS WHO ARE UNCONSCIOUS. THESE ARE TESTED BY STIMULATING A SENSORY NERVE AND WATCHING FOR A REFLEX MOTOR RESPONSE.
- WHEN BRAINSTEM HERNIATION SYNDROMES OCCUR, CRANIAL NERVE FUNCTION CAN BE LOST IN DESCENDING ORDER (IF THE ORIGIN OF THE INJURY IS ABOVE THE TENTORIUM).
- □CN I AND II ARE LOCATED ABOVE THE BRAINSTEM; CN III THROUGH XII ARE LOCATED ALONG THE BRAINSTEM. CN XI (ACCESSORY) HAS ITS ORIGIN FROM THE SPINE, RISING UP TO GIVE THE APPEARANCE OF A CN LOCATED BETWEEN X AND XII.
- CN III IS LOCATED AT THE LEVEL OF THE TENTORIUM; SUDDEN LOSS OF CN III FUNCTION (DECREASED REACTIVITY AND DILATION OF THE PUPIL) SUGGESTS HERNIATION AT THE TOP OF THE BRAINSTEM. THIS IS THE MOST IMPORTANT CN TO TEST IN CRITICAL CARE; SUDDEN DECREASE IN FUNCTION IS AN URGENT FINDING.
- DASYMMETRICAL LOSS OF ANY CN FUNCTION MAY INDICATE UNILATERAL COMPRESSION
- BECAUSE OF THEIR ARRANGEMENT ALONG THE BRAINSTEM, MOST OF THE BRAINSTEM REFLEX TESTS INVOLVE TESTING CRANIAL NERVE FUNCTION.*FOR ACCURACY, CN IV (THE ONLY CRANIAL NERVE THAT ARISES FORM THE POSTERIOR CORD) PROVIDES CONTRALATERAL FUNCTION. BECAUSE OF ITS LENGTH AND POINT OF CROSSING, COMPRESSION TYPICALLY OCCURS AFTER CROSSING, THEREFORE, SYMPTOMS REMAIN IPSILATERAL. THIS IS RARELY A SIGNIFICANT CN TO TEST IN THE CRITICAL CARE POPULATION.

CRANIAL NERVE I- OLFACTORY:

- A) CHECK THAT AIR CAN MOVE FREELY THROUGH EACH NOSTRIL BY OCCLUDING ONE AT A TIME.
- B) USE AN ALCOHOL PAD TO CHECK SENSE OF SMELL. WITH THE PATIENT'S EYES CLOSED, SLOWLY BRING THE ALCOHOL PAD UP
- TOWARDS THEIR NOSE. THE SMELL IS USUALLY DETECTED AT A DISTANCE OF ABOUT 3-4 INCHES

CRANIAL NERVE II OPTIC- VISUAL FIELDS

 THIS NERVE IS TESTED BY ASSESSING A PERSON'S VISION.





CRANIAL NERVE II- OPTIC:

- A) CHECK VISUAL ACUITY BY USING EITHER A SNELLEN EYE CHART AT A DISTANCE, OR A HAND HELD VISUAL ACUITY CARD. IF A PATIENT
- WEARS GLASSES, LET HER/HIM KEEP THEM ON. TEST EACH LINE WITH THE PATIENT UNTIL THEY ARE NOT ABLE TO READ THE
- LETTERS CLEARLY.
- B) FOR CHECKING VISUAL FIELDS, FACE THE PATIENT AT THE SAME LEVEL, ABOUT 1-2 FEET APART. HAVE YOUR PATIENT CLOSE
- HIS/HER RIGHT EYE, WHILE YOU CLOSE YOUR LEFT. RAISE YOUR INDEX FINGER AND HOLD YOUR LEFT ARM OUT UNTIL YOUR INDEX
- FINGER IS JUST OUTSIDE YOUR FIELD OF VISION. MOVE YOUR FINGER AND BEGIN BRINGING IT IN TOWARDS YOUR NOSE. TELL YOUR
- PATIENT TO LET YOU KNOW WHEN HE/SHE SEES IT; YOU SHOULD BOTH BE ABLE TO SEE IT AT THE SAME TIME. DO THIS TEST
- FROM THE UPPER LEFT FIELD, MIDDLE FIELD, AND LOWER LEFT FIELD OF VISION. REPEAT THE TEST WITH THE OTHER EYE, USING
- YOUR RIGHT INDEX FINGER.
- C) PUPILLARY RESPONSES SHOULD ALSO BE TESTED. THIS TESTS BOTH CRANIAL NERVES II AND III.

CRANIAL NERVES II & III-OPTIC AND OCCULOMOTOR PUPILLARY LIGHT REFLEX





- CRANIAL NERVE III- OCULOMOTOR; CRANIAL NERVE IV- TROCHLEAR; CRANIAL NERVE VI-ABDUCENS:
- A) WHILE PATIENT HOLDS HIS/HER HEAD STILL, TRACE AN "H" IN THE AIR, AND HAVE THE PATIENT FOLLOW YOUR FINGER WITH ONLY
- THEIR EYES.
- B) AN ALTERNATE TEST IS TRACING A RECTANGLE IN THE AIR INSTEAD OF THE "H".

CRANIAL NERVES III, IV, & VI-OCULOMOTOR, TROCHLEAR, ABDUCENS INSPECTION & OCULAR ALIGNMENT

- HAVE PATIENT "FOLLOW YOUR FINGER WITH THEIR EYES WITHOUT MOVING THEIR HEAD".
 - MOVE YOUR FINGER SIDE TO SIDE, THEN UP AND DOWN (IN AN "H" PATTERN)
 - LOOK FOR FAILURE OF MOVEMENT AND NYSTAGMUS



Figure 2-4: The action and nerve supply of the extraocular muscles.



- 4. CRANIAL NERVE V- TRIGEMINAL:
- A) SENSORY: HAVE THE PATIENT CLOSE HIS/HER EYES. LIGHTLY TOUCH ABOVE THE EYE (TEMPORAL), ON THE CHEEK, AND ON THE
- JAWBONE (MANDIBULAR), ASKING PATIENT TO ASK WHEN HE/SHE FEELS THE TOUCH AND WHERE.
- MATERIAL PROTECTED BY COPYRIGHT
- B) MOTOR: HAVE THE PATIENT CLENCH AND GRIND HIS/HER TEETH. WHILE DOING SO, PALPATE THE TEMPORAL AND MANDIBULAR
- AREAS TO FEEL IF THERE IS EQUAL STRENGTH AND MOVEMENT.
- C) CORNEAL REFLEX: USE A SMALL PIECE OF COTTON, AND TOUCH THE OUTER AREA OF THE CORNEA. THE PATIENT SHOULD BLINK IN
- REFLEX.
- TESTING CRANIAL NERVES

CRANIAL NERVE V & VII – TRIGEMINAL, AND FACIAL SENSORY, CORNEAL REFLEX, & MOTOR

- TO TEST FOR PAIN, TOUCH, & TEMPERATURE
 - GENTLY TOUCH PATIENT'S FACE WITH CLEAN SAFETY PIN & HOT AND COLD OBJECTS
- CORNEAL REFLEX
 - GENTLY USE A COTTON WISP ON THE PATIENT'S CORNEA.
- TO TEST MOTOR FUNCTION
 - HAVE THE PATIENT CLENCH THEIR TEETH AND MOVE THEIR JAW SIDE TO SIDE.









- CRANIAL NERVE VII- FACIAL:
- A) OBSERVE FOR FACIAL SYMMETRY WITH THE PATIENT'S RELAXED EXPRESSION.
- B) HAVE THE PATIENT WRINKLE HIS/HER FOREHEAD, SMILE, PUFF OUT CHEEKS, AND FROWN. THE FACIAL EXPRESSIONS SHOULD
- DEMONSTRATE SYMMETRY.

CRANIAL NERVE VIII ACOUSTIC

- VESTIBULO-COCHLEAR NERVE-
 - WHISPER IN PATIENT'S EAR AND HAVE THEM REPEAT WHAT YOU SAID
 - IF DEAFNESS IS SUSPECTED, PERFORM RINNE'S TEST AND WEBER'S TEST.





6. CRANIAL NERVE VIII- VESTIBULOCOCHLEAR:

- A) RUB YOUR FINGERS TOGETHER NEXT TO EACH EAR. ASK PATIENT IF THE SOUND IS THE SAME ON BOTH SIDES.
- B) WHISPER A WORD OVER THE PATIENT'S RIGHT SHOULDER AND THEN THE LEFT, AND ASK THE PATIENT TO REPEAT THE WORD BACK
- TO YOU.
- C) USE A TUNING FORK BY STRIKING ON THE PALM OF YOUR HAND, AND THEN PLACE ON THE PATIENT'S SKULL, MIDLINE. THE PATIENT
- SHOULD BE ABLE TO HEAR THE RINGING EQUALLY IN BOTH EARS.

CRANIAL NERVES IX & X-GLOSSOPHARYNGEAL AND VAGUS MOTOR

- OBSERVE ABILITY TO COUGH, SWALLOW, AND TALK.
- TEST MOTOR FUNCTION:
 - ASK PATIENT TO OPEN MOUTH AND SAY "AH" WHILE YOU DEPRESS THE TONGUE WITH A TONGUE BLADE.
 - OBSERVE SOFT PALATE AND UVULA
 - SOFT PALATE AND UVULA SHOULD RISE MEDIALLY.



- CRANIAL NERVE IX- GLOSSOPHARYNGEAL; CRANIAL NERVE X- VAGUS; CRANIAL NERVE XII-HYPOGLOSSAL:
- A) HAVE THE PATIENT STICK OUT HIS/HER TONGUE AND SAY "AHHHHH." THE UVULA SHOULD BE MIDLINE, AND THE PALATE AND
- UVULA SHOULD RISE. THE TONGUE SHOULD ALSO BE MIDLINE.
- B) USING A TONGUE BLADE OR A COTTON TIP SWAB, TOUCH IT AT THE BACK OF THE MOUTH/UVULA. THIS SHOULD ELICIT THE GAG
- REFLEX.

CRANIAL NERVES XI & XII-SPINAL ACCESSORY AND HYPOGLOSSAL MOTOR

- CN XI- ACCESSORY SPINAL NERVE.
 - HAVE PATIENT SHRUG THEIR SHOULDERS OR TURN HEAD SIDE TO SIDE
- CN XII- CONTROLS MOVEMENT OF THE TONGUE.
 - HAVE PATIENT STICK OUT THEIR TONGUE AND ASSESS FOR MIDLINE







- CRANIAL NERVE XI- SPINAL ACCESSORY:
- A) ASK YOUR PATIENT TO TURN HIS/HER HEAD TO THE LEFT, WHILE YOU PLACE SOME RESISTANCE AGAINST THEIR FACE WITH YOUR
- RIGHT HAND. REPEAT THIS WITH THE PATIENT TURNING TO THE RIGHT WITH RESISTANCE. THE
 STRENGTH SHOULD BE EQUAL
- BILATERALLY.
- B) PLACE YOUR HANDS ON THE PATIENT'S SHOULDERS, AND ASK HIM/HER TO SHRUG WHILE YOU PLACE SOME RESISTANCE. THE
- SHOULDER STRENGTH SHOULD BE EQUAL BILATERALLY.

VITAL SIGNS & NEURO STATUS

- THE BRAIN STEM & VAGUS NERVE (CN X) PLAY AN IMPORTANT PART IN VASOMOTOR TONE.
 - CONDITIONS AFFECTING THESE AREAS CAN CAUSE VITAL SIGNS TO CHANGE
- CUSHING'S TRIAD
 - INDICATES AN INCREASE IN ICP
 - CHANGE IN RESPIRATIONS, OFTEN IRREGULAR, DEEP, & BRADYPNEA RATE- SUCH AS CHEYNE STOKES
 - BRADYCARDIA
 - INCREASING SYSTOLIC BP WITH WIDENING PULSE PRESSURE (THE DIFFERENCE BETWEEN THE SYSTOLIC AND DIASTOLIC BP)
- CUSHING'S TRIAD IS A LATE SIGN OF INCREASED ICP
 - ONCE THIS BEGINS, BRAIN STEM HERNIATION IS MOST LIKELY ALREADY IN PROGRESS & IT MAY BE TOO LATE TO REVERSE.
 - TO DETECT INCREASING ICP BEFORE IT REACHES THIS POINT, BE ALERT FOR EARLIER SIGNS: A SUBTLE CHANGE IN LOC OR PUPILS, FOR EXAMPLE.

1. MARSHALL, R. S., & MAYER, S. A. (2001). ON CALL NEUROLOGY (2ND ED.). NEW YORK: W. B. SAUNDERS.

2. VOS, H. (2002). THE NEUROLOGIC ASSESSMENT. IN E. BARKER (ED.), NEUROSCIENCE NURSING: SPECTRUM OF CARE (2ND ED.). ST. LOUIS: MOSBY.

3. HICKEY, J. V. (2003). THE CLINICAL PRACTICE OF NEUROLOGICAL AND NEUROSURGICAL NURSING (5TH ED). PHILADELPHIA: LIPPINCOTT.

4. BADER, M. K., & LITTLEJOHNS, L. R. (2004). AANN CORE CURRICULUM FOR NEUROSCIENCE NURSING (4TH ED.). PHILADELPHIA: SAUNDERS.

5. KERR, M. E. (2000). INTRACRANIAL PROBLEMS. IN S. M. LEWIS, M. M. HEITKEMPER, & S. R. DIRKSEN (EDS.), *MEDICAL SURGICAL NURSING* (5TH ED). ST. LOUIS: MOSBY.

6. NOAH, P (2004) NEUROLOGICAL ASSESSMENT: A REFRESHER. RN/DREXEL HOME STUDY PROGRAM CENTER. MODERN MEDICINE. ADVANSTAR COMMUNICATIONS.

7. JARVIS, C. (2011). PHYSICAL EXAMINATION AND HEALTH ASSESSMENT (6TH ED). ST. LOUIS: W.B. SAUNDERS.

8. SHAW, M. (2012). ASSESSMENT MADE INCREDIBLY EASY (5TH ED.). PHILADELPHIA, PA: LIPPINCOTT WILLIAMS & WILKINS.