Pediatric Acute Ischemic Stroke

Clinical Practice Guideline (CPG)

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SSM Health Cardinal Glennon

Cardinal Glennon Acute Ischemic Stroke Guideline

Referring Hospital Flow Diagram

Goals: 1) Initiate stroke-reversal treatment prior to transfer if indicated
2) Determine the appropriate transfer destination

Inclusion Criteria: Last known well (LKW) < 24 hours AND age ≥ 2 y/o

- Head of bed flat unless increased ICP is suspected
- Contact CG Neurology via Access center (1-888-229-2424)

- Ask the Stroke-relevant questions (see box to the right)
- Blood Pressure
- Place largest possible IV for patient size x2 in a site that can receive contrast (antecubital preferred)
- STAT Labs - CBC, CMP, PT/PTT/INR
- STAT POC urine hcg if post-menarchal female (bedpan or straight cath)
- Make patient NPO, start NS maintenance fluids

Sickle cell Disease → Stat CT head without contrast; if no hemorrhage, then give Aspirin; Transfer to CG emergently

- Maintain blood pressure between lower limit (Appendix A, Column B) and permissive HTN limit (Column D)
- Decrease SBP by 15% if above the permissive HTN upper limit (Column D)
- Treat to bring glucose to > 50 mg/dl and < 400 mg/dl

STAT CT head without contrast AND
CTA head and neck with contrast

Hemorrhage → Consult CG Neurosurgery
Exit stroke guideline

No Hemorrhage → LKW <4.5 hr

No → Thrombolytics Contraindicated → Give Aspirin ASAP

Yes

- Assess for contraindications to thrombolytics (Appendix B)
- Goal BP below limit for thrombolytics (Appendix A, Column C)
- BP management per (Appendix A)

→ Give thrombolytic with neurology attending approval and verbal guardian consent

Is there a large vessel occlusion on CTA?

No Large Vessel Occlusion → Transfer to CG ED Emergently

Large Vessel Occlusion → Consult CG Neurology for transfer recommendations

Stroke-Relevant Questions

1) What are the neuro deficits?
2) Symptoms improving spontaneously?
3) History of Sickle cell disease, congenital heart disease, or bleeding/clotting disorder?
4) Pregnant?
5) Cognitive/functional baseline?
6) Currently taking anticoagulant or antiplatelet medications?
7) Major surgery in the past 10 days?

Thrombolytic Dosing

Tenecteplase (TNK) [Preferred]
0.25mg/kg (Max 25mg) IV (bolus) (Appendix C)

Alteplase (tPA) [Alternative]
0.9mg/kg (Max 90mg) IV (give 10% over 1 minute, and the remainder over 1 hour)

Aspirin Dosing

<15kg - 40.5mg
15-30kg - 81 mg
30-65kg - 160 mg
>65kg - 325 mg

If unable to safely give orally due to facial/oral weakness or altered mental status, then give rectally (same dose oral or rectal)

Cardinal Glennon Flow Diagram

Inclusion Criteria: Last known well (LKW) < 24 hours AND age ≥ 2 y/o

- Head of bed flat unless increased ICP is suspected
- Notify attending, Activate code stroke
- Page Neurology
- Neurology fellow is expected to come in to examine the patient, but this should not delay moving forward with this guideline

- Ask the Stroke-relevant questions (see box to the right)
- Place largest possible IV for patient size x2 in a site that can receive contrast (antecubital preferred)
- STAT Labs - CBC, CMP, PT/PTT/INR
- STAT POC urine hcg if post-menarchal female (bedpan or straight cath)
- Make patient NPO, start NS maintenance fluids

Sickle cell Disease → Go to sickle cell stroke protocol (Page 4)

- Maintain SBP between lower limit (Appendix A, Column B) and permissive HTN limit (Column D)
- Decrease SBP by 15% if above the permissive HTN upper limit (Column D)
- Treat to bring glucose to > 50 mg/dl and < 400 mg/dl

STAT CT head without contrast AND
CTA head and neck with contrast

Hemorrhage → Page Neurosurgery Exit stroke guideline

No hemorrhage and unclear if stroke → Rapid stroke MRI if available (defer if patient has dental braces)

No Hemorrhage and convincing for stroke

Radiology confirms no hemorrhage
Clinically suspicious for stroke or MRI diagnostic of stroke

LKW > 4.5hr → Thrombolytics Contraindicated → Give Aspirin ASAP

LKW <4.5hr

- Assess for contraindications to thrombolytics (Appendix B)
- Goal BP below limit for thrombolytics (Appendix A, Column C)
- BP management per (Appendix A)

→ Give thrombolytic with neurology attending approval and verbal guardian consent

Is there a large vessel occlusion on CTA?

No Large Vessel Occlusion → Admit to PICU

Large Vessel Occlusion → Discuss with CG Neurology for recommendations

Stroke-Relevant Questions

1) What are the neuro deficits?
2) Symptoms improving spontaneously?
3) History of Sickle cell disease, congenital heart disease, or bleeding/clotting disorder?
4) Pregnant?
5) Cognitive/functional baseline?
6) Currently taking anticoagulant or antiplatelet medications?
7) Major surgery in the past 10 days?

Thrombolytic Dosing

Tenecteplase (TNK) [Preferred]
0.25mg/kg (Max 25mg) IV (bolus)

Alteplase (tPA) [Alternative]
0.9mg/kg (Max 90mg) IV
(give 10% over 1 minute, and the remainder over 1 hour)

Aspirin Dosing

<15kg - 40.5mg
15-30kg - 81 mg
30-65kg - 160 mg
>65kg - 325 mg

If unable to safely give orally due to facial/oral weakness or altered mental status, then give rectally (same dose oral or rectal)

Sickle Cell Flow Diagram

Inclusion Criteria: Last known well (LKW) < 72 hours AND known history of Hb SS / SC / Sickle-beta thalassemia

- Head of bed flat unless increased ICP is suspected
- Notify attending, Activate code stroke
- Page Neurology and Hematology with "acute stroke" in the page
- Neurology fellow is expected to come in to examine the patient, but this should not delay moving forward with this guideline

↓

- Ask the Stroke-relevant questions (see box to the right)
- Place largest possible IV for patient size x2 in a site that can receive contrast (antecubital preferred)
- STAT Labs - CBC, CMP, PT/PTT/INR, Reticulocyte count, Blood culture, Type and cross, Hemoglobin S quant
- STAT POC urine hcg if post-menarchal female (bedpan or straight cath)
- Make patient NPO, start NS maintenance fluids

↓

- Maintain blood pressure between lower limit (Appendix A, Column B) and permissive HTN limit (Column D)
- Decrease SBP by 15% if above the permissive HTN upper limit (column D)
- Treat to bring glucose to > 50 mg/dl and < 400 mg/dl

↓

STAT CT head without contrast AND
CTA head and neck with contrast

Hemorrhage →
- Consult Neurosurgery
- Continue protocol if indicated per hematology

No Hemorrhage ↓

Discuss simple transfusion volume with hematology and plan for exchange transfusion

Hb≤8.5g/dL ↓
- Simple transfusion (volume per hematology)
- Phone discussion with blood bank to communicate the urgency of the situation
- Pause mIVF during transfusion

Hb>8.5g/dL ↓

No simple transfusion

↓

Is there a large vessel occlusion on CTA?

No Large Vessel Occlusion ↓

Give Aspirin ASAP if no hemorrhage on CT

Admit to PICU for Exchange Transfusion

Large Vessel Occlusion ↓

Consider Thrombolytics if LKW<4.5 hours AND thromboembolism is suspected AND no hemorrhage on CT AND no other contraindications

If TPA/TNK was NOT given and is NOT indicated, give Aspirin ASAP

↓

Discuss with CG Neurology for recommendations

Stroke-Relevant Questions

1) What are the neuro deficits?

2) Symptoms improving spontaneously?

3) History of congenital heart disease or bleeding/clotting disorder?

4) Pregnant?

5) Cognitive/functional baseline?

6) Currently taking anticoagulant or antiplatelet medications?

7) Major surgery in the past 10 days?

Aspirin Dosing

<15kg - 40.5mg

15-30kg - 81 mg

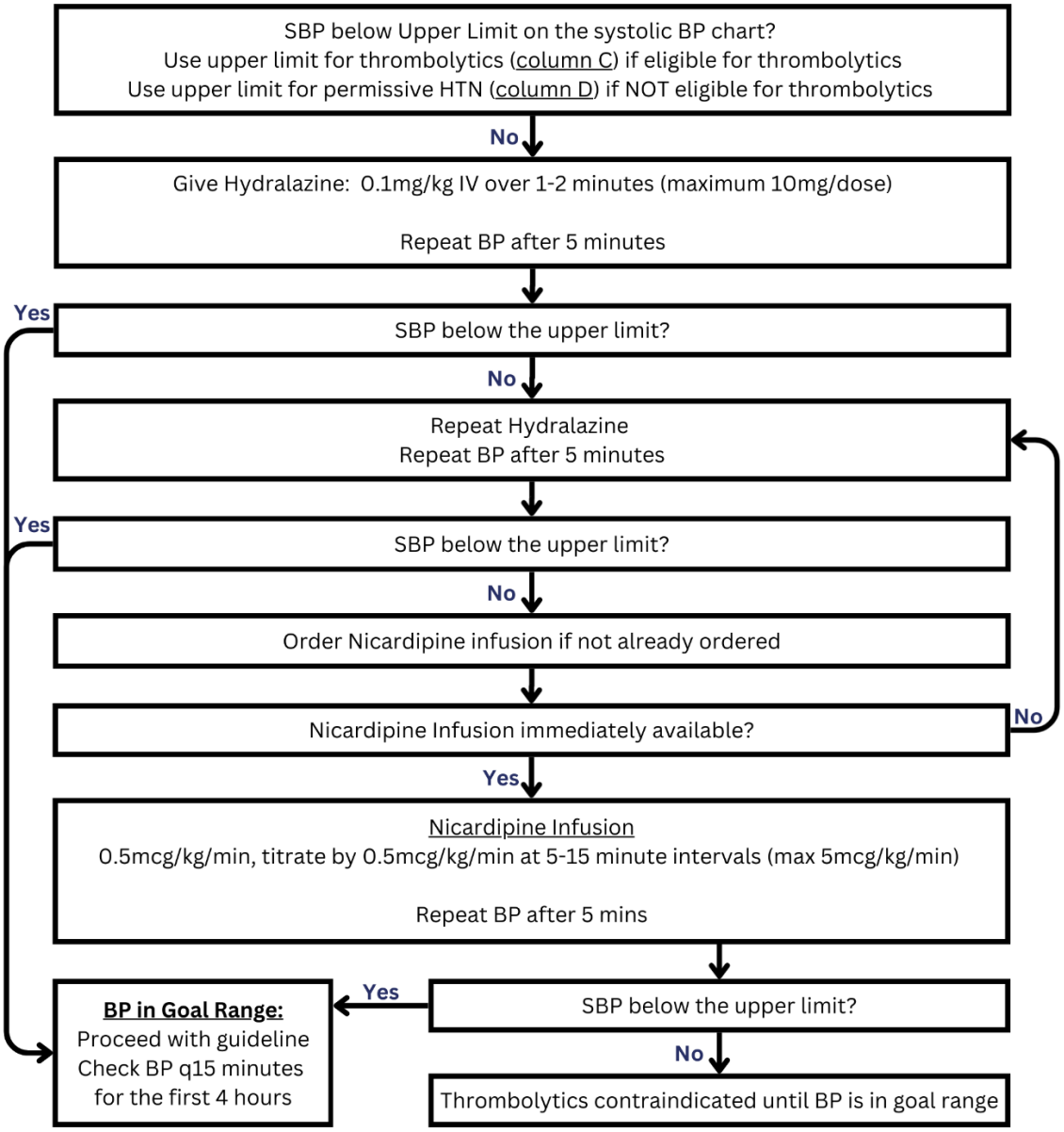
30-65kg - 160 mg

>65kg - 325 mg

If unable to safely give orally due to facial/oral weakness or altered mental status, then give rectally (same dose PO vs PR)

Appendix A – Blood Pressure Management

Systolic Blood Pressure Parameters			
(A) Age (yrs)	**(B)** Lower Limit (50%)	**(C)** Upper Limit for Thrombolytics (95+15%)	**(D)** Upper Limit for Permissive HTN (95+20%)
1-3	85	125	130
4-6	90	130	135
7-9	95	135	140
10-12	100	140	145
13-15	105	150	155
16-17	115	155	160
18+	120	185	220



Appendix B – Thrombolytic Exclusion Criteria

Absolute Contraindications	Relative Contraindications

History/Patient Factors

- >4.5 hours from last known well or unknown last known well
- Non-disabling symptoms or rapidly improving symptoms
- Clinical presentation suggestive of subarachnoid hemorrhage even if imaging is negative for blood
- Active major bleeding
- Moderate to severe TBI or neurosurgery within 14 days
- Acute spinal cord injury within 3 months
- Primary or metastatic Intra-axial neoplasm (extra axial neoplasms are probably safe)
- Known/suspected bleeding diathesis including platelet, INR/PT/PTT abnormalities (see Appendix D)
- Currently taking anticoagulant medications (see Appendix E)
- Pregnancy and post-partum period
- Severe pre-existing disability such that the risks of thrombolytics outweigh the lost quality of life from a stroke
- Prior stroke, major trauma, or intracranial/intraspinal surgery within the past 3 months
- Major surgery or parenchymal biopsy within 10 days
- GI or GU hemorrhage within 21 days or known structural GI malignancy at risk of bleeding
- Arterial puncture at a noncompressible site (cardiac cath via a compressible artery is NOT excluded)
- Lumbar puncture within 7 days
- Patient with active malignancy or within 1 month of completion of treatment for cancer
- Arteriovenous malformation – Consider IV thrombolytics if moderate to severe stroke with stroke morbidity and mortality likely to outweigh risk of intracranial hemorrhage (Unruptured aneurysm is probably safe)
- Prior intracranial hemorrhage
  - Incidental chronic micro-hemorrhages on MRI (<10) are NOT a contraindication to IV thrombolytics
  - Consider IV thrombolytics in individuals with old resolved traumatic intracranial hemorrhage (including subdural and epidural hematomas)
  - Consider IV thrombolytics for individuals with history of aneurysmal subarachnoid hemorrhage with aneurysms that are felt to be adequately secured
  - Consider IV thrombolytics in a patient with a remote history of perinatal hemorrhage

Exam/Vital Signs

- HTN above the upper limit for thrombolytics (Appendix A, Column C) (ok to proceed if HTN is lowered to the goal range)
- If last known well is 3 - 4.5 hours, severe deficit suggesting large territory stroke, with PedNIHSS >24, regardless of infarct volume seen on neuroimaging (ok to give thrombolytics if last known well is <3 hours)

Imaging

- Intracranial hemorrhage on CT
- Frank acute infarct on CT (early mild-moderate change is NOT a contraindication)
- Aortic arch dissection
- Intracranial arterial dissection (extracranial dissection is NOT a contraindication)

Etiology

- Infective endocarditis
- Clinical presentation consistent with acute myocardial infarction (MI) or pericarditis that requires evaluation by cardiology before treatment
- Left atrial or ventricular thrombus
- Stroke suspected to be due to sickle cell disease, meningitis, bone marrow, air, or fat embolism
- Previously diagnosed primary angiitis of the central nervous system or secondary CNS vasculitis (Focal cerebral arteriopathy of childhood is NOT a contraindication)

Labs

- Uncorrected hypoglycemia < 50mg/dL (ok to give thrombolytic once glucose is corrected to ≥ 50, if sx persist)
- Uncorrected hyperglycemia >400 mg/dL (ok to give thrombolytic once glucose is corrected to <400 if sx persist)

Other

- Patient who would decline blood transfusion if indicated
- Known allergy to recombinant tissue plasminogen activator/tenecteplase

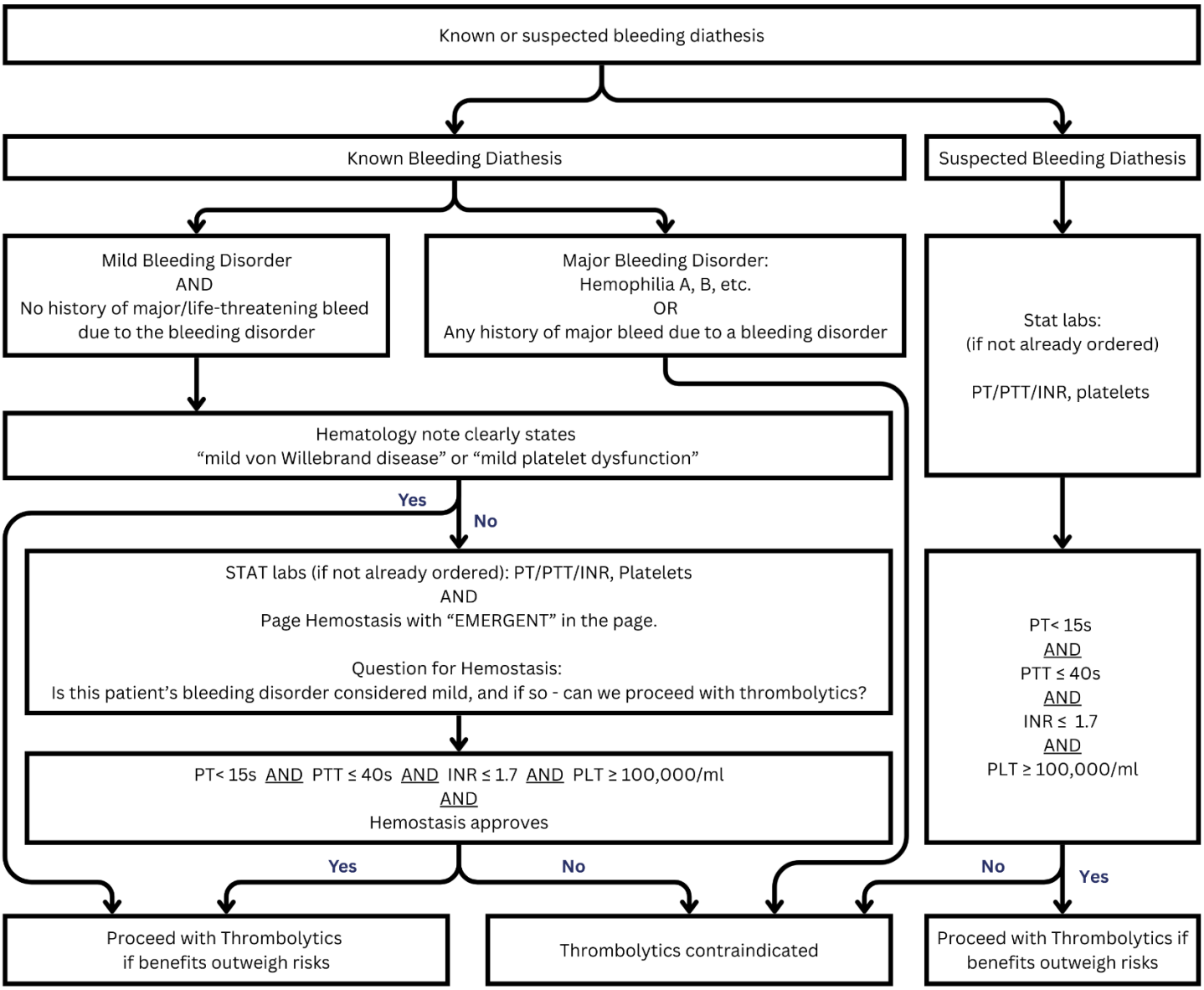
Appendix C – Tenecteplase Dosing Table

Pediatric Tenecteplase Dosing Table Compounded Concentration 5 mg/mL		
Weight (kg)	**Dose (mg)**	**Volume (mL)**
10 - 13.9	3	0.6
14 - 17.9	4	0.8
18 - 21.9	5	1
22 - 25.9	6	1.2
26 - 29.9	7	1.4
30 - 33.9	8	1.6
34 - 37.9	9	1.8
38 - 41.9	10	2
42 - 45.9	11	2.2
46 - 49.9	12	2.4
50 - 53.9	13	2.6
54 - 57.9	14	2.8
58 - 61.9	15	3
62 - 65.9	16	3.2
66 - 69.9	17	3.4
70 - 73.9	18	3.6
74 - 77.9	19	3.8
78 - 81.9	20	4
82 - 85.9	21	4.2
86 - 89.9	22	4.4
90 - 93.9	23	4.6
94 - 97.9	24	4.8
>98	25	5

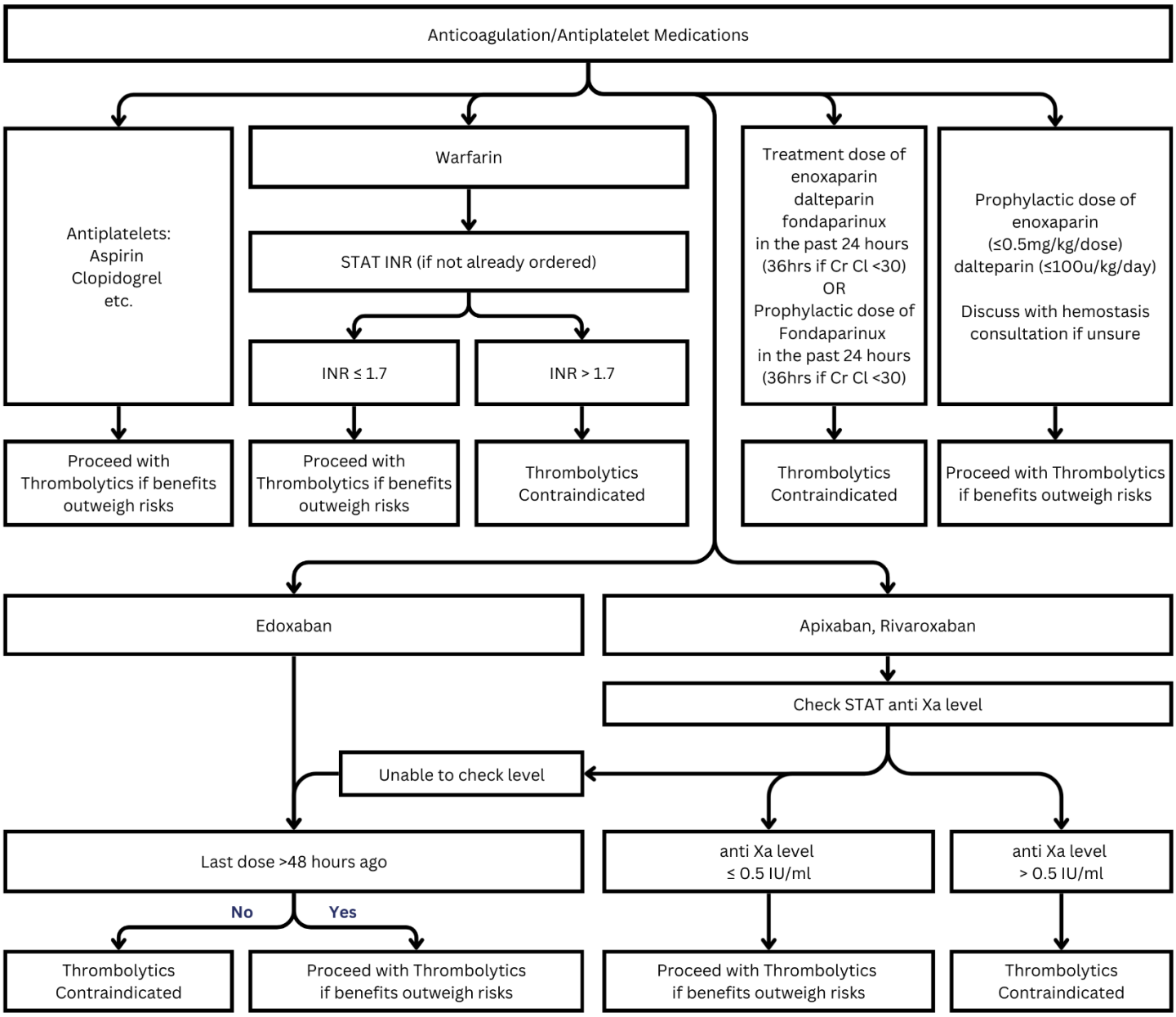
Administer Tenecteplase as a bolus over 5-10 seconds

Tenecteplase is NOT compatible with dextrose-containing fluids

Appendix D – Pre-Existing Bleeding Diathesis



Appendix E – Pre-Existing Anticoagulation Use



Heparin anti Xa levels can be used to estimate DOAC levels for Apixaban and Rivaroxaban

A standard anti Xa level of <0.5 U/ml suggests DOAC levels are low enough to safely give thrombolytics

Appendix F – Rapid Stroke MRI

“Rapid Stroke MRI”

- DWI and ADC sequences

Epic order:

- MRI brain WO contrast
- Write “Rapid Stroke MRI” in the comments

To be used to confirm the diagnosis of stroke before giving thrombolytics when the diagnosis is uncertain

If the patient has dental braces, rapid stroke MRI should not be done due to substantial artifact degradation of DWI/ADC images

Rapid stroke MRI is only available during regular daytime hours

Appendix G – Secondary Hemorrhage Due to Thrombolytics

Suspect secondary hemorrhage if there is:

- Acute neurological deterioration
- New headache
- Acute hypertension
- New nausea/vomiting

If hemorrhage is suspected:

- Hold the thrombolytic infusion if it is still running
- STAT CT head without contrast
- CBC, PT, aPTT, PT/INR, platelet count, fibrinogen level, type and cross (if not already done), TEG

If hemorrhage is confirmed:

- Administer:
    - Cryoprecipitate 1 u per 10kg (max 10 u) over 10-30 min

      AND
        - Tranexamic acid 15mg/kg (max 1000mg) IV infused over 10 minutes

          OR
        - Aminocaproic acid 100mg/kg (max 5000mg)
- Check fibrinogen after Cryoprecipitate
    - If <150, repeat Cryoprecipitate
- Neurosurgery consult
- Consider Platelet transfusion if <100,000

Appendix H – Post-Ischemic Stroke ICU Management

Sickle Cell Stroke Only

- Pheresis catheter placed by PICU ASAP
- Apheresis team called in for emergent exchange transfusion, parameters per hematology

All Ischemic Strokes

Nursing

- Neuro-check q 1 hour x 6 h, q2 x 12 h, and q4 x 48 hours
- Vitals q 15 min x 2 hours post iv TPA, q1 x12 h, q2 x 12 h, then q2 thereafter
- HOB flat x 24 hours then liberalized
- Seizure precautions
- Bedrest x at least 24 hours
- SCDs (delay 24 hours after thrombolytics)
- POC glucose q4h
- NPO until cleared by bedside swallow
- For 8 hours post IV thrombolytic administration: Closely monitor potential bleeding sites; avoid IM/SQ injections, rectal temperature/suppositories, lumbar punctures, urinary catheterization, indwelling catheter placement/removal, arterial punctures, or nasogastric tube placement. Carefully perform venipunctures only if necessary.
- If post-mechanical thrombectomy - Strict bed rest, including flat time with straight extremity until time recommended by Neurointerventional. If necessary, use dexmedetomidine infusion to protect puncture site during flat time.

Supportive Care

- Normal O2, CO2, pH. Supplemental oxygen for SpO2 ≤95 or depressed mental status
- Normotension: target SBP between 50th and 90th% for age, treat low BP with NS +/- pressors, treat significant HTN to lower by ~15% over 24 hours. Appendix A for blood pressure targets. Drug choice per PICU physician.
- Blood Pressure Care: Isotonic fluid (0.9% NS) at 1.5 x maintenance with bolus prn
- Normoglycemia: For age ≥ 2 years, no glucose in IV fluids unless hypoglycemic; for age < 2 years, use glucose-containing fluids
- Maintain normothermia – acetaminophen for temperature >100.4F (38C). Consider cooling blanket only if unable to control temperature. Consider infectious workup as indicated.
- Seizure control: Lorazepam ASAP with any suspected seizure activity, ensure adequate blood pressure is maintained and avoid hypotension.

Continuous EEG

- If patient has any mental status deficit from baseline for detection of subclinical seizures, which should be treated aggressively to avoid worsening deficit confused for repeat stroke. (Hold off on EEG if going to angiogram, delays critical intervention).

Labs

- Comprehensive Urine Drug Screen
- Thrombophilia workup (this includes homocysteine, factor 8, d-dimer, protein C and S, antithrombin III, factor 5 Leiden and prothrombin gene mutations, lupus anticoagulant and beta 2 glycoprotein, and anticardiolipin Ab, ANA, plasminogen, ds-DNA)
- Other labs to consider: serum amino acids, urine organic acids, lipid profile, TSH, LFT, lactate, ammonia, MTHFR, Factor 9 activity, hemoglobin electrophoresis, antineuronal AB, C3, C4, sed rate, RF, ANCA panel
- Daily Labs: CMP, CBC, DIC panel, TEG

Cardiac Evaluation

- EKG, Echo with bubble study, (TEE if standard echo does not get an adequate view of all chambers)

Imaging

- Brain MRI when stable
- Repeat imaging (CT or MRI) at 12-24 hours after Thrombolytics, or immediately if there is deterioration.

Therapy

- Swallow evaluation
- OT/PT eval, Rankin Jordan Physiatry consult if inpatient rehab is likely needed

Decompressive hemicraniectomy - a consideration for *malignant MCA stroke (greater than 50% of MCA territory infarcted AND mental status deterioration)*. Earlier intervention is proven to be of more benefit than later.

Appendix I – PedNIHSS

PedNIHSS INSTRUCTIONS: Administer stroke scale items in the order listed. Follow directions provided for each exam item. Scores should reflect what the patient does, not what the clinician thinks the patient can do. *MODIFICATIONS FOR CHILDREN: Modifications to testing instructions from the adult version for use in children are shown in italic with each item where appropriate. Items with no modifications should be administered and scored with children in the same manner as for adults.*

Item# and Instructions	Scale Definition and Scoring Guide	
1a. Level of Consciousness: the investigator must choose a response, even if a full evaluation is prevented by such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.	0	Alert; keenly responsive
	1	Not alert, but arousable by minor stimulation to obey, answer, or respond.
	2	Not alert, requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements (not stereotyped).
	3	Responds only with reflex motor or autonomic effects or totally unresponsive, flaccid, areflexic.
1b. LOC Questions: The patient is asked the month and his/her age. The answer must be correct - there is no partial credit for being close. Aphasic and stuporous patients who do not comprehend the questions will score 2. Patients unable to speak because of endotracheal intubation, orotracheal trauma, severe dysarthria from any cause, language barrier or any other problem not secondary to aphasia are given a 1. It is important that only the initial answer be graded and that the examiner not "help" the patient with verbal or non-verbal cues. *Modified for children, age 2 years and up. A familiar Family Member must be present for this item: Ask the child "how old are you?" Or "How many years old are you?" for question number one. Give credit if the child states the correct age or shows the correct number of fingers for his/her age. For the second question, ask the child "where is XX?", XX referring to the name of the parent or other familiar family member present. Use the name for that person which the child typically uses, e.g. "mommy". Give credit if the child correctly points to or gazes purposefully in the direction of the family member.*	0	Answers both questions correctly
	1	Answers one question correctly
	2	Answers neither question correctly

1c. LOC Commands: The patient is asked to open and close the eyes and then to grip and release the non-paretic hand. For children one may substitute the command to grip the hand with the command “show me your nose” or “touch your nose”. Substitute another one step command if the hands cannot be used. Credit is given if an unequivocal attempt is made but not completed due to weakness. If the patient does not respond to command, the task should be demonstrated to them (pantomime) and score the result (i.e., follows none, one or two commands). Patients with trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored.	0	Performs both tasks correctly
	1	Performs 1 task correctly
	2	Performs neither task correctly
2. Best Gaze: Only horizontal eye movements will be tested. Voluntary or reflexive (oculocephalic) eye movements will be scored but caloric testing is not done. If the patient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be 1. If a patient has an isolated peripheral nerve paresis (CN III, IV or VI) score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness or other disorder of visual acuity or fields should be tested with reflexive movements and a choice made by the investigator. Establishing eye contact and then moving about the patient from side to side will occasionally clarify the presence of a partial gaze palsy.	0	Normal
	1	Partial gaze palsy. This score is given when gaze is abnormal in one or both eyes, but where forced deviation or total gaze paresis are not present.
	2	Forced deviation, or total gaze paresis not overcome by the oculocephalic maneuver.
3. Visual: Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting *(for children > 6 years)* or visual threat *(for children age 2 to 6 years)* as appropriate. Patient must be encouraged, but if they look at the side of the moving fingers appropriately, this can be scored as normal. If there is unilateral blindness or enucleation, visual fields in the remaining eye are scored. Score 1 only if a clear-cut asymmetry, including quadrantanopia is found. If patient is blind from any cause score 3. Double simultaneous stimulation is performed at this point. If there is extinction patient receives a 1 and the results are used to answer question 11.	0	No visual loss
	1	Partial hemianopia
	2	Complete hemianopia
	3	Bilateral hemianopia (blind including cortical blindness)

4. Facial Palsy: Ask or use pantomime to encourage the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barrier obscures the face, these should be removed to the extent possible.	0	Normal symmetrical movement
	1	Minor paralysis (flattened nasolabial fold, asymmetry on smiling)
	2	Partial paralysis (total or near total paralysis of lower face)
	3	Complete paralysis of one or both sides (absence of facial movement in the upper and lower face)
5 & 6. Motor Arm and Leg: The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine) and the leg 30 degrees (always tested supine). Drift is scored if the arm falls before 10 seconds or the leg before 5 seconds. *For children too immature to follow precise directions or uncooperative for any reason, power in each limb should be graded by observation of spontaneous or elicited movement according to the same grading scheme, excluding the time limits.* The aphasic patient is encouraged using urgency in the voice and pantomime but not noxious stimulation. Each limb is tested in turn, beginning with the non-paretic arm. Only in the case of amputation or joint fusion at the shoulder or hip, or immobilization by an IV board, may the score be "9" and the examiner must clearly write the explanation for scoring as a "9". Score each limb separately.		**5a. Left Arm 5b. Right Arm**
	0	No drift, limb holds 90 (or 45) degrees for full 10 seconds.
	1	Drift, Limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support
	2	Some effort against gravity, limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity
	3	No effort against gravity, limb falls
	4	No movement
	9	Amputation, joint fusion explain:
		6a. Left Leg 6b. Right Leg
	0	No drift, limb holds 90 (or 45) degrees for full 10 seconds
	1	Drift, Limb holds 90 (or 45) degrees, but drifts down before full 10 seconds; does not hit bed or other support
	2	Some effort against gravity, limb cannot get to or maintain (if cued) 90 (or 45) degrees, drifts down to bed, but has some effort against gravity
	3	No effort against gravity, limb falls
	4	No movement
	9	Amputation, joint fusion explain:

7. Limb Ataxia: This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. In case of visual defect, ensure testing is done in intact visual field. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. *In children, substitute this task with reaching for a toy for the upper extremity, and kicking a toy or the examiner's hand, in children too young (< 5 years) or otherwise uncooperative for the standard exam item.* Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion may the item be scored "9", and the examiner must clearly write the explanation for not scoring. In case of blindness test by touching nose from extended arm position.	0	Absent
	1	Present in one limb
	2	Present in two limbs
8. Sensory: Sensation or grimace to pin prick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. *For children too young or otherwise uncooperative for reporting gradations of sensory loss, observe for any behavioral response to pin prick, and score it according to the same scoring scheme as a "normal" response, "mildly diminished" or "severely diminished" response*. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas [arms (not hands), legs, trunk, face] as needed to accurately check for hemisensory loss. A score of 2, "severe or total," should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will therefore probably score 1 or 0.	0	Normal; no sensory loss.
	1	Mild to moderate sensory loss; patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware he/she is being touched.
	2	Severe to total sensory loss; patient is not aware of being touched in the face, arm, and leg.

9. Best Language: A great deal of information about comprehension will be obtained during the preceding sections of the examination. *For children age 6 years and up with normal language development before onset of stroke: The patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet, to repeat words from the attached list, and to read from the attached list of sentences (Table S1; Fig S1, S2, S3).* Comprehension is judged from responses here as well as to all of the commands in the preceding general neurological exam. If visual loss interferes with the tests, ask the patient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in coma (question 1a=3) will arbitrarily score 3 on this item. The examiner must choose a score in the patient with stupor or limited cooperation but a score of 3 should be used only if the patient is mute and follows no one step commands. *For children age 2 yrs to 6 yrs (or older children with premorbid language skills < 6 yr level), score this item based on observations of language comprehension and speech during the examination.*	0	No aphasia, normal
	1	Mild to moderate aphasia; some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided material difficult or impossible. For example, in conversation about provided materials examiner can identify picture or naming card from patient's response.
	2	Severe aphasia: all communication is through fragmentary expression; great need for inference, questioning, and guessing by the listener. Range of information that can be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient response
	3	Mute, global aphasia; no usable speech
		If the patient does not respond and is quadriplegic score "2". *Patients in coma (item 1a=3) are arbitrarily given a "2" on this item (best language).*
10. Dysarthria: If patient is thought to be normal, an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barrier to producing speech may the item be scored "9", and the examiner must clearly write an explanation for not scoring. Do not tell the patient why he/she is being tested.	0	Normal
	1	Mild to moderate; patient slurs at least some words and, at worst, can be understood with some difficulty
	2	Severe; patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric
	9	Intubated or other physical barrier: explain

11. Extinction and Inattention (formerly neglect): Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia, but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosognosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.	0	No abnormality
	1	Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities
	2	Profound hemi-inattention or hemi-inattention to more than one modality. does not recognize own hand or orients to only one side of space

If there is a "9" for limb amputation/joint fusion, document why, but do not add to the total score.

Repetition	Each of 4 word-repetition tasks is presented: a. Stop b. Stop and go c. If it rains we play inside d. The President lives in Washington
Reading	Each of 3 items is presented for the child to read in Fig 1. Adjust expectations according to the child's age/school level
Naming	Pictures are presented: a clock, pencil, skateboard, shirt, baseball, bicycle (Fig 2)
Fluency and word Finding	The picture (Fig 3) is presented, and the child is asked to describe what he/she sees

Table S1. Language testing Items for PEDNIHSS

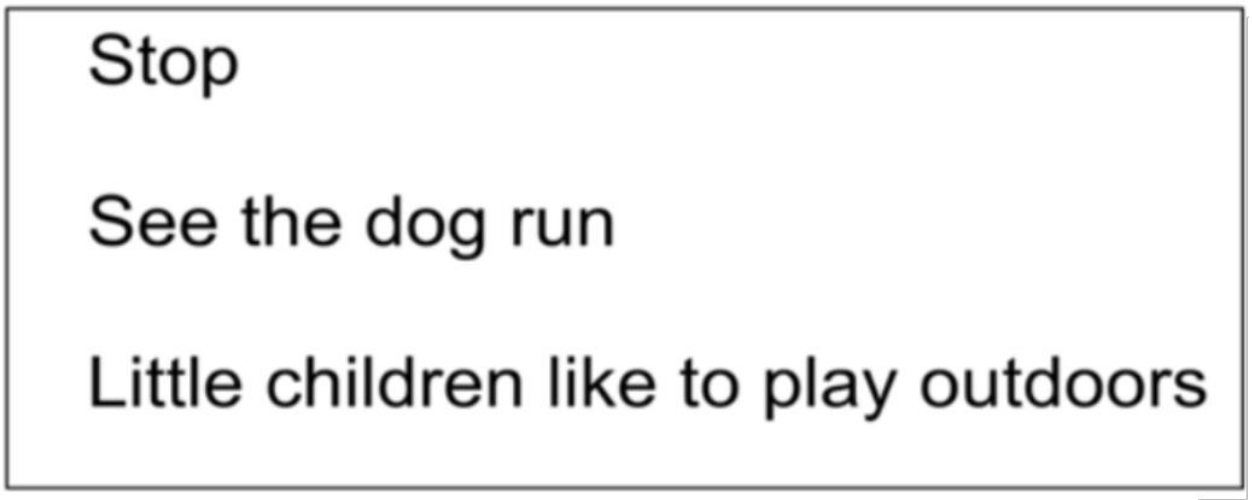


Fig S1. Reading items for PedNIHSS

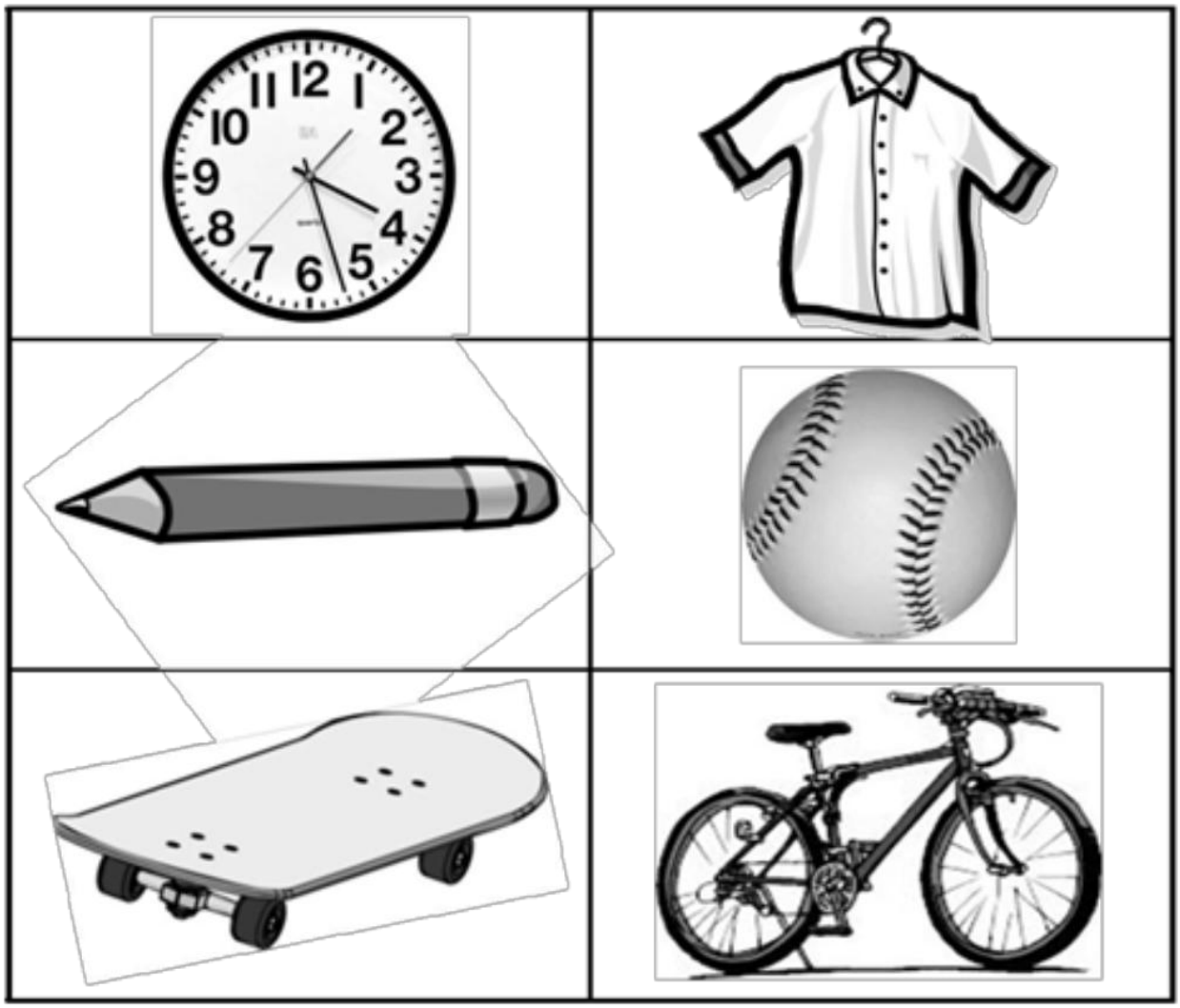


Fig. S2 Pictures to test naming for Item 9 Best Language of PedNIHSS

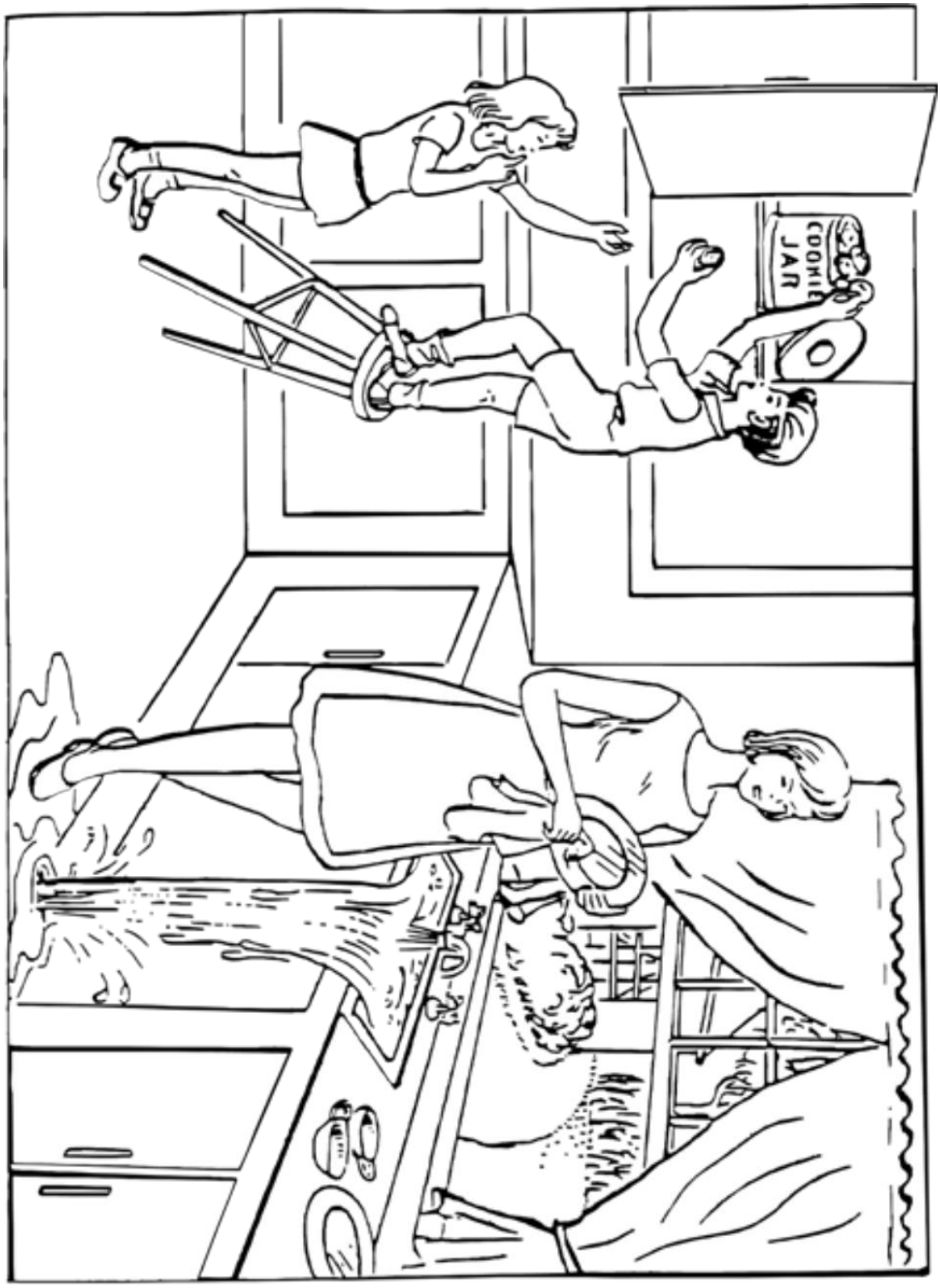


Fig. S3 Picture to test story-telling for Item 9 Best Language of PedNIHSS

PEDNIHSS SCORING TABLE

	NIHSS	Score
LOC	0 1 2 3	
LOC - Questions	0 1 2	
LOC - Commands	0 1 2	
Best Gaze	0 1 2	
Visual	0 1 2 3	
Facial Palsy	0 1 2 3	
Motor Right Arm	0 1 2 3 4	
Motor Left Arm	0 1 2 3 4	
Motor Right Leg	0 1 2 3 4	
Motor Left Leg	0 1 2 3 4	
Limb Ataxia	0 1 2	
Sensory	0 1 2	
Best Language	0 1 2 3	
Dysarthria	0 1 2 intub	
Extinction	0 1 2	
Total		

If there is a "9" for limb amputation/joint fusion, document why, but do not add to the total score.

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