برخورد با سکته های مغزی در اورژانس

1.5. Hospital Stroke Teams

1.5. Hospital Stroke Teams	COR	LOE	New, Revised, or Unchanged
1. An organized protocol for the emergency evaluation of patients with suspected stroke is recommended.	I	B-NR	Recommendation and COR unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.
2. Designation of an acute stroke team that includes physicians, nurses, and laboratory/radiology personnel is recommended. Patients with stroke should have a careful clinical assessment, including neurological examination.	I	B-NR	Recommendation wording modified from 2013 AIS Guidelines to match COR I stratifications. COR unchanged. LOE added to conform with ACC/AHA 2015 Recommendation Classification System.
3. Multicomponent quality improvement initiatives, which include ED education and multidisciplinary teams with access to neurological expertise, are recommended to safely increase IV fibrinolytic treatment.	I	A	New recommendation.
4. It is recommended that stroke systems of care be developed so that fibrinolytic-eligible patients and mechanical thrombectomy-eligible patients receive treatment in the fastest achievable onset-to-treatment time.	I	A	Recommendation revised from 2013 AIS Guidelines.

5. Establishing and monitoring target time goals for ED door-to-treatment IV fibrinolysis time can be beneficial to monitor and enhance system performance.	**I**	**B-NR**	New recommendation.
In AHA GWTG-Stroke hospitals, median DTN time for IV alteplase administration decreased from 77 minutes (interquartile range, 60–98 minutes) during the 2003 to 2009 preintervention period to 67 minutes (interquartile range, 51–87 minutes) during the 2010 to 2013 postintervention period ($P<0.001$). The percentage of alteplase-treated patients having DTN times of ≤60 minutes increased from 26.5% (95% CI, 26.0–27.1) to 41.3% (95% CI, 40.8–41.7; $P<0.001$). Comparing the quarter immediately before the intervention (quarter 4 of 2009) and the final postintervention quarter (quarter 3 of 2013) showed that DTN times of ≤60 minutes increased from 29.6% (95% CI, 27.8–31.5) to 53.3% (95% CI, 51.5–55.2; $P<0.001$).[53] In a subsequent study evaluating a cohort of hospitals from 2014 to 2015, 59.3% of patients received IV alteplase within a DTN time of 60 minutes.[54]			See Table IX in online Data Supplement 1.

1.6. Telemedicine	COR	LOE
1. For sites without in-house imaging interpretation expertise, teleradiology systems approved by the US Food and Drug Administration are recommended for timely review of brain imaging in patients with suspected acute stroke.	I	A
2. When implemented within a telestroke network, teleradiology systems approved by the US Food and Drug Administration are effective in supporting rapid imaging interpretation in time for IV alteplase administration decision making.	I	A
Studies of teleradiology to read brain imaging in acute stroke have successfully assessed feasibility; agreement between telestroke neurologists, radiologists, and neuroradiologists over the presence or absence of radiological contraindications to IV alteplase; and reliability of telestroke radiological evaluations. Further support for this unchanged recommendation from the 2013 AIS Guidelines with LOE upgraded to A is provided by 3 additional studies published since the 2013 Guidelines.[55–57]		
3. The use of telemedicine/telestroke resources and systems should be supported by healthcare institutions, governments, payers, and vendors as one method to ensure adequate 24/7 coverage and care of acute stroke patients in a variety of settings.	I	C-EO
4. Telestroke/teleradiology evaluations of AIS patients can be effective for correct IV alteplase eligibility decision making.	IIa	B-R
The STRokEDOC (Stroke Team Remote Evaluation Using a Digital Observation Camera) pooled analysis supported the hypothesis that telemedicine consultations, which included teleradiology, compared with telephone-only resulted in statistically significantly more accurate IV alteplase eligibility decision-making for patients exhibiting symptoms and signs of an acute stroke syndrome in EDs.[58]		

1.6. Telemedicine (Continued)	COR	LOE
5. Administration of IV alteplase guided by telestroke consultation for patients with AIS can be beneficial.	**IIa**	**B-NR**
A systematic review and meta-analysis was performed to evaluate the safety and efficacy of IV alteplase delivered through telestroke networks in patients with AIS. sICH rates were similar between patients subjected to telemedicine-guided IV alteplase and those receiving IV alteplase at stroke centers. There was no difference in mortality or in functional independence at 3 months between telestroke-guided and stroke center–managed patients. The findings indicate that IV alteplase delivery through telestroke networks is safe and effective in the 3-hour time window.[59]		
6. Telestroke networks may be reasonable for triaging patients with AIS who may be eligible for interfacility transfer in order to be considered for emergency mechanical thrombectomy.	**IIb**	**B-NR**
An observational study compared clinical outcomes of EVT between patients with anterior circulation stroke transferred after teleconsultation and those directly admitted to a tertiary stroke center. The study evaluated 151 patients who underwent emergency EVT for anterior circulation stroke. Of these, 48 patients (31.8%) were transferred after teleconsultation, and 103 (68.2%) were admitted primarily through an ED. Transferred patients were younger, received IV alteplase more frequently, had prolonged time from stroke onset to EVT initiation, and tended to have lower rates of symptomatic intracranial hemorrhage and mortality than directly admitted patients. Similar rates of reperfusion and favorable functional outcomes were observed in patients treated by telestroke and those who were directly admitted. Telestroke networks may enable the triage and the delivery of EVT to selected ischemic stroke patients transferred from remote hospitals.[60]		
7. Providing alteplase decision-making support via telephone consultation to community physicians is feasible and safe and may be considered when a hospital has access to neither an in-person stroke team nor a telestroke system.	**IIb**	**C-LD**
The advantages of telephone consultations for patients with acute stroke syndromes are feasibility, history of use, simplicity, availability, portability, short consultation time, and facile implementation.[61]		

2. Emergency Evaluation and Treatment

2.1. Stroke Scales

2.1. Stroke Scales	COR	LOE	New, Revised, or Unchanged
1. The use of a stroke severity rating scale, preferably the NIHSS, is recommended.	I	B-NR	Recommendation reworded for clarity from 2013 AIS Guidelines. COR unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
Formal stroke scores or scales such as the NIHSS (Table 4) may be performed rapidly, have demonstrated utility, and may be administered by a broad spectrum of healthcare providers with accuracy and reliability.[75,76] Use of a standardized scale quantifies the degree of neurological deficit, facilitates communication, helps identify patients for fibrinolytic or mechanical intervention, allows objective measurement of changing clinical status, and identifies those at higher risk for complications such as intracerebral hemorrhage (ICH).[71–73,77]			See Table XV in online Data Supplement 1.

Table 4. National Institutes of Health Stroke Scale

Tested Item	Title	Responses and Scores
1A	Level of consciousness	0—Alert
		1—Drowsy
		2—Obtunded
		3—Coma/unresponsive
1B	Orientation questions (2)	0—Answers both correctly
		1—Answers 1 correctly
		2—Answers neither correctly
1C	Response to commands (2)	0—Performs both tasks correctly
		1—Performs 1 task correctly
		2—Performs neither
2	Gaze	0—Normal horizontal movements
		1—Partial gaze palsy
		2—Complete gaze palsy
3	Visual fields	0—No visual field defect
		1—Partial hemianopia
		2—Complete hemianopia
		3—Bilateral hemianopia
4	Facial movement	0—Normal
		1—Minor facial weakness
		2—Partial facial weakness
		3—Complete unilateral palsy
5	Motor function (arm)	0—No drift
	a. Left	1—Drift before 10 s
	b. Right	2—Falls before 10 s
		3—No effort against gravity
		4—No movement
6	Motor function (leg)	0—No drift
	a. Left	1—Drift before 5 s
	b. Right	2—Falls before 5 s
		3—No effort against gravity
		4—No movement
7	Limb ataxia	0—No ataxia
		1—Ataxia in 1 limb
		2—Ataxia in 2 limbs
8	Sensory	0—No sensory loss
		1—Mild sensory loss
		2—Severe sensory loss
9	Language	0—Normal
		1—Mild aphasia
		2—Severe aphasia
		3—Mute or global aphasia
10	Articulation	0—Normal
		1—Mild dysarthria
		2—Severe dysarthria
11	Extinction or inattention	0—Absent
		1—Mild loss (1 sensory modality lost)
		2—Severe loss (2 modalities lost)

Adapted from Lyden et al.[74] Copyright © 1994, American Heart Association, Inc.

2.2. Head and Neck Imaging

2.2.1. Initial Imaging	COR	LOE	New, Revised, or Unchanged
1. All patients with suspected acute stroke should receive emergency brain imaging evaluation on first arrival to a hospital before initiating any specific therapy to treat AIS.	I	A	Recommendation reworded for clarity from 2013 AIS Guidelines. COR and LOE unchanged. See Table XCV in online Data Supplement 1 for original wording.
2. Systems should be established so that brain imaging studies can be performed as quickly as possible in patients who may be candidates for IV fibrinolysis or mechanical thrombectomy or both.	I	B-NR	New recommendation.
The benefit of IV alteplase is time dependent, with earlier treatment within the therapeutic window leading to bigger proportional benefits.[42,78] A brain imaging study to exclude ICH is recommended as part of the initial evaluation of patients who are potentially eligible for these therapies. With respect to endovascular treatment, a pooled analysis of 5 randomized trials comparing EVT with medical therapy alone in which the majority of the patients were treated within 6 hours found that the odds of improved disability outcomes at 90 days (as measured by the mRS score distribution) declined with longer time from symptom onset to arterial puncture.[42] The 6- to 16- and 6- to 24-hour treatment windows trials, which used advanced imaging to identify a relatively uniform patient group, showed limited variability of treatment effect with time in these highly selected patients.[51,52] The absence of detailed screening logs in these trials limits estimations of the true impact of time in this population. To ensure that the highest proportion of eligible patients presenting in the 6- to 24-hour window have access to mechanical thrombectomy, evaluation and treatment should be as rapid as possible. Reducing the time interval from ED presentation to initial brain imaging can help to reduce the time to treatment initiation. Studies have shown that median or mean door-to-imaging times of ≤20 minutes can be achieved in a variety of different hospital settings.[79–81]			See Tables XVI and XVII in online Data Supplement 1.
3. Noncontrast CT (NCCT) is effective to exclude ICH before IV alteplase administration.	I	A	Recommendation revised from 2013 AIS Guidelines.
4. Magnetic resonance (MR) imaging (MRI) is effective to exclude ICH before IV alteplase administration.	I	B-NR	Recommendation revised from 2013 AIS Guidelines.
5. CTA with CTP or MR angiography (MRA) with diffusion-weighted magnetic resonance imaging (DW-MRI) with or without MR perfusion is recommended for certain patients.	I	A	New recommendation.
In many patients, the diagnosis of ischemic stroke can be made accurately on the basis of the clinical presentation and either a negative NCCT or one showing early ischemic changes, which can be detected in the majority of patients with careful attention.[82,83] NCCT scanning of patients with acute stroke is effective for the rapid detection of acute ICH. NCCT was the only neuroimaging modality used in the National Institute of Neurological Disorders and Stroke (NINDS) rt-PA (Recombinant Tissue-Type Plasminogen Activator) trials and in ECASS (European Cooperative Acute Stroke Study) III and is therefore sufficient neuroimaging for decisions about IV alteplase in most patients.[48,49] Immediate CT scanning provides high value for patients with acute stroke.[84,85] MRI was as accurate as NCCT in detecting hyperacute intraparenchymal hemorrhage in patients presenting with stroke symptoms within 6 hours of onset when gradient echo sequences were used.[86,87] In patients who awake with stroke or have unclear time of onset >4.5 hours from baseline or last known well, MRI to identify diffusion-positive fluid-attenuated inversion recovery (FLAIR)–negative lesions can be useful for selecting those who can benefit from IV alteplase administration within 4.5 hours of stroke symptom recognition.[88] CTA with CTP or MRA with DW-MRI with or without MR perfusion is useful for selecting candidates for mechanical thrombectomy between 6 and 24 hours after last known well.[51,52] See specific recommendations below.			See Tables XVII through XX in online Data Supplement 1.

2.2.2. IV Alteplase Eligibility	COR	LOE	New, Revised, or Unchanged
1. Administration of IV alteplase in eligible patients without first obtaining MRI to exclude cerebral microbleeds (CMBs) is recommended.	I	B-NR	New recommendation.
CMBs are common in patients receiving IV alteplase, occurring in 15% to 27%.[89–94] Such patients were undoubtedly included in the pivotal NINDS and ECASS III trials that established the benefits of IV alteplase treatment.[48,49] Two meta-analyses of the association of baseline CMBs and the risk of sICH after IV alteplase reported that sICH is more common in patients with baseline CMBs, whereas 2 other meta-analyses and 1 multicenter study did not.[89–93] In 2 studies using ECASS II sICH criteria, the rates in patients with CMBs were 5.8% and 6.5% compared with 5.3% in ECASS III.[49,90,91] One study analyzing the risk of sICH in patients with CMBs detected after IV alteplase treatment reported sICH of 5% using the NINDS criteria compared with 6.4% in the NINDS tPA trials.[48,94] The risk of sICH in patients with >10 CMBs (30%–47%) is consistently reported as significantly greater than in those with no CMBs (1%–4.4%). However, these data are based on <50 patients, constituting <2% of these series.[90,91,93,94] No RCTs of IV alteplase in AIS with baseline MRI to identify CMBs have been conducted, so no determination of the effect of baseline CMB on the treatment effect of alteplase with CMB is available. In the absence of direct evidence that IV alteplase provides no benefit or produces harm in eligible patients with CMBs, withholding treatment on the basis of the presence of CMBs could lead to the exclusion of patients who would benefit from treatment.			See Table XXI in online Data Supplement 1.

2.2.2. IV Alteplase Eligibility (Continued)	COR	LOE	New, Revised, or Unchanged
2. In patients eligible for IV alteplase, because benefit of therapy is time dependent, treatment should be initiated as quickly as possible and not delayed for additional multimodal neuroimaging, such as CT and MRI perfusion imaging.	I	B-NR	New recommendation.
NCCT was the only neuroimaging modality used in the NINDS rt-PA trial and in ECASS III and is therefore sufficient neuroimaging for decisions about IV alteplase in most patients.[48,49] Multimodal CT and MRI, including diffusion and perfusion imaging, are not necessary when the diagnosis of ischemic stroke is very likely, and their performance may delay time-sensitive administration of IV alteplase. In some cases, particularly when there is substantial diagnostic uncertainty, advanced imaging may be beneficial.			See Table XX in online Data Supplement 1.
3. In patients with AIS who awake with stroke symptoms or have unclear time of onset > 4.5 hours from last known well or at baseline state, MRI to identify diffusion-positive FLAIR-negative lesions can be useful for selecting those who can benefit from IV alteplase administration within 4.5 hours of stroke symptom recognition.	IIa	B-R	New recommendation.
The WAKE-UP trial (Efficacy and Safety of MRI-based Thrombolysis in Wake-Up Stroke) randomized 503 patients with AIS who awoke with stroke or had unclear time of onset >4.5 hours from last known well and could be treated with IV alteplase within 4.5 hours of stroke symptom recognition. Eligibility required MRI mismatch between abnormal signal on DW-MRI and no visible signal change on FLAIR. DW-MRI lesions larger than one-third of the territory of the middle cerebral artery (MCA), NIHSS score >25, contraindication to treatment with alteplase, or planned thrombectomy were all exclusions. The trial was terminated early for lack of funding before the designated 800 patients were randomized. Ninety-four percent were wake-up strokes. Median NIHSS score was 6. Median time from last known well was slightly over 10 hours. At baseline, one-third of the patients had vessel occlusion on time-of-flight MRA, and three-quarters of the FLAIR lesions were <9 mL. The end point of an mRS score of 0 to 1 at 90 days was achieved in 53.3% of the IV alteplase group and in 41.8% of the placebo group (P=0.02).[88]			See Table XIX in online Data Supplement 1

2.2.3. Mechanical Thrombectomy Eligibility–Vessel Imaging	COR	LOE	New, Revised, or Unchanged
1. For patients who otherwise meet criteria for mechanical thrombectomy, noninvasive vessel imaging of the intracranial arteries is recommended during the initial imaging evaluation.	I	A	Recommendation reworded for clarity from 2015 Endovascular. COR and LOE unchanged. See Table XCV in online Data Supplement 1 for original wording.
2. For patients with suspected LVO who have not had noninvasive vessel imaging as part of their initial imaging assessment for stroke, noninvasive vessel imaging should then be obtained as quickly as possible (eg, during alteplase infusion if feasible).	I	A	Recommendation revised from 2015 Endovascular. COR and LOE unchanged.
A recent systematic review evaluated the accuracy of prediction instruments for diagnosing LVO.[4] In the setting where confirmed ischemic stroke patients would be assessed by a neurologist or emergency physician in the ED, the authors suggested that the NIHSS score is the best of the LVO prediction instruments. According to their meta-analysis, a threshold of ≥10 would provide the optimal balance between sensitivity (73%) and specificity (74%). To maximize sensitivity (at the cost of lower specificity), a threshold of ≥6 would have 87% sensitivity and 52% specificity. However, even this low threshold misses some cases with LVO, whereas the low specificity indicates that false-positives will be common. The sensitivity of CTA and MRA compared with the gold standard of catheter angiography ranges from 87% to 100%, with CTA having greater accuracy than MRA.[95,96] Pivotal trials of mechanical thrombectomy all required noninvasive CTA or MRA diagnosis of LVO as an inclusion criterion.			See Tables XVII and XXII in online Data Supplement 1.
3. In patients with suspected intracranial LVO and no history of renal impairment, who otherwise meet criteria for mechanical thrombectomy, it is reasonable to proceed with CTA if indicated before obtaining a serum creatinine concentration.	IIa	B-NR	New recommendation.
Analyses from a number of observational studies suggest that the risk of contrast-induced nephropathy secondary to CTA imaging is relatively low, particularly in patients without a history of renal impairment. Moreover, waiting for these laboratory results may lead to delays in mechanical thrombectomy.[97–102]			See Table XXIII in online Data Supplement 1.
4. In patients who are potential candidates for mechanical thrombectomy, imaging of the extracranial carotid and vertebral arteries, in addition to the intracranial circulation, may be reasonable to provide useful information on patient eligibility and endovascular procedural planning.	IIb	C-EO	New recommendation.
Knowledge of vessel anatomy and presence of extracranial vessel dissections, stenoses, and occlusions may assist in planning endovascular procedures or identifying patients ineligible for treatment because of vessel tortuosity or inability to access the intracranial vasculature.			

2.2.3. Mechanical Thrombectomy Eligibility–Vessel Imaging (Continued)	COR	LOE	New, Revised, or Unchanged
5. It may be reasonable to incorporate collateral flow status into clinical decision-making in some candidates to determine eligibility for mechanical thrombectomy.	**IIb**	**C-LD**	Recommendation revised from 2015 Endovascular.
Several studies, including secondary analyses from MR CLEAN (Multicenter Randomized Clinical Trial of Endovascular Treatment for AIS in the Netherlands) and IMS (Interventional Management of Stroke) III, provide data supporting the role of collateral assessments in identifying patients likely or unlikely to benefit from mechanical thrombectomy.[103,104] The ESCAPE trial (Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion With Emphasis on Minimizing CT to Recanalization Times), using multiphase CTA to select patients with moderate to good collateral circulation for mechanical thrombectomy up to 12 hours from onset, was stopped early for efficacy.[105] Acquisition of advanced imaging should not delay door–to–groin puncture times.			See Tables XXIV and XXV in online Data Supplement 1.

2.2.4. Mechanical Thrombectomy Eligibility–Multimodal Imaging	COR	LOE	New, Revised, or Unchanged
1. When selecting patients with AIS within 6 to 24 hours of last known normal who have LVO in the anterior circulation, obtaining CTP or DW-MRI, with or without MRI perfusion, is recommended to aid in patient selection for mechanical thrombectomy, but only when patients meet other eligibility criteria from one of the RCTs that showed benefit from mechanical thrombectomy in this extended time window.	**I**	**A**	New recommendation.
The DAWN trial (Clinical Mismatch in the Triage of Wake Up and Late Presenting Strokes Undergoing Neurointervention With Trevo) used clinical-core mismatch (a combination of age-adjusted NIHSS score and age-adjusted core infarct size on CTP or DW-MRI) as an eligibility criterion to select patients with large anterior circulation vessel occlusion for mechanical thrombectomy between 6 and 24 hours from last known normal. This trial demonstrated an overall benefit in functional outcome at 90 days in the treatment group (mRS score 0–2, 49% versus 13%; adjusted difference, 33% [95% CI, 21–44]; posterior probability of superiority >0.999).[51] The DEFUSE 3 trial (Diffusion and Perfusion Imaging Evaluation for Understanding Stroke Evolution) used perfusion-core mismatch and maximum core size as imaging criteria to select patients with large anterior circulation occlusion 6 to 16 hours from last seen well for mechanical thrombectomy. This trial showed a benefit in functional outcome at 90 days in the treated group (mRS score 0–2, 44.6% versus 16.7%; RR, 2.67 [95% CI, 1.60–4.48]; $P<0.0001$).[52] Benefit was independently demonstrated for the subgroup of patients who met DAWN eligibility criteria and for the subgroup who did not. DAWN and DEFUSE 3 are the only RCTs showing benefit of mechanical thrombectomy >6 hours from onset. Therefore, only the eligibility criteria from one or the other of these trials should be used for patient selection. Although future RCTs may demonstrate that additional eligibility criteria can be used to select patients who benefit from mechanical thrombectomy, at this time, the DAWN or DEFUSE 3 eligibility should be strictly adhered to in clinical practice.[51,52]			See Table XVII in online Data Supplement 1.

2. When evaluating patients with AIS within 6 hours of last known normal with LVO and an Alberta Stroke Program Early Computed Tomography Score (ASPECTS) of ≥6, selection for mechanical thrombectomy based on CT and CTA or MRI and MRA is recommended in preference to performance of additional imaging such as perfusion studies.	**I**	**B-NR**	New recommendation.
Of the 6 RCTs that independently demonstrated clinical benefit of mechanical thrombectomy with stent retrievers when performed <6 hours from stroke onset, 4 trials (REVASCAT [Randomized Trial of Revascularization With Solitaire FR Device Versus Best Medical Therapy in the Treatment of Acute Stroke Due to Anterior Circulation Large Vessel Occlusion Presenting Within Eight Hours of Symptom Onset], SWIFT PRIME [Solitaire With the Intention for Thrombectomy as Primary Endovascular Treatment], EXTEND-IA [Extending the Time for Thrombolysis in Emergency Neurological Deficits–Intra-Arterial], and ESCAPE)[105–108] used some form of advanced imaging to determine eligibility, whereas 2 (THRACE [Trial and Cost Effectiveness Evaluation of Intra-Arterial Thrombectomy in Acute Ischemic Stroke] and MR CLEAN)[109,110] required only NCCT and demonstration of LVO. Because the last 2 studies independently demonstrated benefit in the treated group, the role of additional imaging-based eligibility criteria is not well established and could lead to the exclusion of patients who would benefit from treatment and are therefore not indicated at this time. Further RCTs may be helpful to determine whether advanced imaging paradigms using CTP, CTA, and MRI perfusion and diffusion imaging, including measures of infarct core and penumbra, are beneficial for selecting patients for reperfusion therapy who are within 6 hours of symptom onset and have an ASPECTS <6.			See Table XVII in online Data Supplement 1.

2.3. Other Diagnostic Tests

2.3. Other Diagnostic Tests	COR	LOE	New, Revised, or Unchanged
1. Only the assessment of blood glucose must precede the initiation of IV alteplase in all patients.	I	B-NR	Recommendation reworded for clarity from 2013 AIS Guidelines. COR unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
Recommendation was modified to clarify that it is only blood glucose that must be measured in all patients. Other tests, for example, international normalized ratio, activated partial thromboplastin time, and platelet count, may be necessary in some circumstances if there is suspicion of coagulopathy. Given the extremely low risk of unsuspected abnormal platelet counts or coagulation studies in a population, IV alteplase treatment should not be delayed while waiting for hematologic or coagulation testing if there is no reason to suspect an abnormal test.			
2. Baseline electrocardiographic assessment is recommended in patients presenting with AIS but should not delay initiation of IV alteplase.	I	B-NR	Recommendation reworded for clarity from 2013 AIS Guidelines. COR unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
3. Baseline troponin assessment is recommended in patients presenting with AIS but should not delay initiation of IV alteplase or mechanical thrombectomy.	I	C-LD	Recommendation reworded for clarity from 2013 AIS Guidelines. COR unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
4. Usefulness of chest radiographs in the hyperacute stroke setting in the absence of evidence of acute pulmonary, cardiac, or pulmonary vascular disease is unclear. If obtained, they should not unnecessarily delay administration of IV alteplase.	IIb	B-NR	Recommendation reworded for clarity from 2013 AIS Guidelines. COR unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
Additional support for this reworded recommendation from the 2013 AIS Guidelines comes from a cohort study of 615 patients, 243 of whom had chest x-ray done before IV alteplase. Cardiopulmonary adverse events in the first 24 hours of admission, endotracheal intubation in the first 7 hours, and in-hospital mortality were not different between the 2 groups. Patients with chest x-ray done before treatment had longer mean DTN times than those who did not (75.8 minutes versus 58.3 minutes; P=0.0001).[111]			See Table XXVI in online Data Supplement 1.

3. General Supportive Care and Emergency Treatment

3.1. Airway, Breathing, and Oxygenation

3.1. Airway, Breathing, and Oxygenation	COR	LOE	New, Revised, or Unchanged
1. Airway support and ventilatory assistance are recommended for the treatment of patients with acute stroke who have decreased consciousness or who have bulbar dysfunction that causes compromise of the airway.	I	C-EO	Recommendation and COR unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.
2. Supplemental oxygen should be provided to maintain oxygen saturation >94%.	I	C-LD	Recommendation and COR unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.
3. Supplemental oxygen is not recommended in nonhypoxic patients with AIS.	III: No Benefit	B-R	Recommendation unchanged from 2013 AIS Guidelines. COR and LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.
Additional support for this unchanged recommendation from the 2013 AIS Guidelines is provided by an RCT of 8003 participants randomized within 24 hours of admission. There was no benefit on functional outcome at 90 days of oxygen by nasal cannula at 2 L/min (baseline O_2 saturation >93%) or 3 L/min (baseline O_2 saturation ≤93%) continuously for 72 hours or nocturnally for 3 nights.[112]			See Table XXVII in online Data Supplement 1.

4.2 Head Positioning	COR	LOE
1. The benefit of flat-head positioning early after hospitalization for stroke is uncertain.	**IIb**	**B-R**

Only 1 sizable trial has evaluated the effect on functional outcomes of flat versus elevated head position after a stroke. HeadPoST (Head Positioning in Acute Stroke Trial) was a large international, cluster-randomized, crossover open-label trial that enrolled any patient hospitalized for stroke (including ICHs) admitted to the hospital to flat-head (0°) or elevated head (≥30°) maintained for 24 hours after randomization.[240] Distribution of mRS scores at 90 days did not differ between the groups (OR, 1.01 [95% CI, 0.92–1.10]; *P*=0.84). Patients in the flat-head position group were less often able to maintain the assigned head position for 24 hours, but rates of pneumonia did not differ between the 2 groups. However, this pragmatic trial has been criticized because of various limitations.[241] HeadPoST enrolled predominantly patients with minor strokes (median NIHSS score 4) who would be less likely to benefit from increased perfusion compared with patients with more severe strokes and large artery occlusions. In addition, the initiation of the intervention was very delayed (median, 14 hours), potentially missing the window in which head positioning could have made a difference. Several small studies have shown that the lying-flat position may improve cerebral perfusion in patients with AIS caused by a large artery occlusion when the intervention is initiated early after stroke onset.[241,242] Thus, there is a rationale for further research focused on this specific cohort of patients.

3.2. Blood Pressure

3.2. Blood Pressure	COR	LOE	New, Revised, or Unchanged
1. Hypotension and hypovolemia should be corrected to maintain systemic perfusion levels necessary to support organ function.	I	C-EO	New recommendation.
The blood pressure (BP) level that should be maintained in patients with AIS to ensure the best outcome is not known. Some observational studies show an association between worse outcomes and lower BPs, whereas others have not.[116–123] No studies have addressed the treatment of low BP in patients with stroke. In a systematic analysis of 12 studies comparing the use of IV colloids and crystalloids, the odds of death or dependence were similar. Clinically important benefits or harms could not be excluded. There are no data to guide volume and duration of parenteral fluid delivery.[124] No studies have compared different isotonic fluids.			See Table XXIX in online Data Supplement 1.
2. Patients who have elevated BP and are otherwise eligible for treatment with IV alteplase should have their BP carefully lowered so that their SBP is <185 mm Hg and their diastolic BP is <110 mm Hg before IV fibrinolytic therapy is initiated.	I	B-NR	Recommendation reworded for clarity from 2013 AIS Guidelines. COR unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System. See Table XCV in online Data Supplement 1 for original wording.
The RCTs of IV alteplase required the BP to be <185 mm Hg systolic and <110 mm Hg diastolic before treatment and <180/105 mm Hg for the first 24 hours after treatment. Options to treat arterial hypertension in patients with AIS who are candidates for immediate reperfusion therapy are given in Table 5. Some observational studies suggest that the risk of hemorrhage after administration of alteplase is greater in patients with higher BPs[125–131] and in patients with more BP variability.[132] The exact BP at which the risk of hemorrhage after IV alteplase increases is unknown. It is thus reasonable to target the BPs used in the RCTs of IV alteplase.			See Tables XX and XXX in online Data Supplement 1.
3. In patients for whom mechanical thrombectomy is planned and who have not received IV fibrinolytic therapy, it is reasonable to maintain BP ≤185/110 mm Hg before the procedure.	IIa	B-NR	Recommendation revised from 2013 AIS Guidelines.
Of the 6 RCTs that each independently demonstrated clinical benefit of mechanical thrombectomy with stent retrievers when performed <6 hours from stroke onset, 5 (REVASCAT, SWIFT PRIME, EXTEND-IA, THRACE, and MR CLEAN)[106–110] had eligibility exclusions for BP >185/110 mm Hg. The sixth, ESCAPE,[105] had no BP eligibility exclusion. DAWN also used an exclusion for BP >185/110 mm Hg.[51] RCT data for optimal BP management approaches in this setting are not available. Because the vast majority of patients enrolled in these RCTs had preprocedural BP managed below 185/110 mm Hg, it is reasonable to use this level as a guideline until additional data become available.			See Table XVII in online Data Supplement 1.
4. The usefulness of drug-induced hypertension in patients with AIS is not well established.	IIb	B-R	Recommendation and COR unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.

Table 5. Options to Treat Arterial Hypertension in Patients With AIS Who Are Candidates for Emergency Reperfusion Therapy*

COR IIb	LOE C-EO
Patient otherwise eligible for emergency reperfusion therapy except that BP is >185/110 mm Hg:	
Labetalol 10–20 mg IV over 1–2 min, may repeat 1 time; or	
Nicardipine 5 mg/h IV, titrate up by 2.5 mg/h every 5–15 min, maximum 15 mg/h; when desired BP reached, adjust to maintain proper BP limits; or	
Clevidipine 1–2 mg/h IV, titrate by doubling the dose every 2–5 min until desired BP reached; maximum 21 mg/h	
Other agents (eg, hydralazine, enalaprilat) may also be considered	
If BP is not maintained ≤185/110 mm Hg, do not administer alteplase	
Management of BP during and after alteplase or other emergency reperfusion therapy to maintain BP ≤180/105 mm Hg:	
Monitor BP every 15 min for 2 h from the start of alteplase therapy, then every 30 min for 6 h, and then every hour for 16 h	
If systolic BP >180–230 mm Hg or diastolic BP >105–120 mm Hg:	
Labetalol 10 mg IV followed by continuous IV infusion 2–8 mg/min; or	
Nicardipine 5 mg/h IV, titrate up to desired effect by 2.5 mg/h every 5–15 min, maximum 15 mg/h; or	
Clevidipine 1–2 mg/h IV, titrate by doubling the dose every 2–5 min until desired BP reached; maximum 21 mg/h	
If BP not controlled or diastolic BP >140 mm Hg, consider IV sodium nitroprusside	

AIS indicates acute ischemic stroke; BP, blood pressure; COR, class of recommendation; IV, intravenous; and LOE, Level of Evidence.

*Different treatment options may be appropriate in patients who have comorbid conditions that may benefit from rapid reductions in BP such as acute coronary event, acute heart failure, aortic dissection, or preeclampsia/eclampsia.

Data derived from Jauch et al.[1]

3.3. Temperature

3.3. Temperature	COR	LOE	New, Revised, or Unchanged
1. Sources of hyperthermia (temperature >38°C) should be identified and treated, and antipyretic medications should be administered to lower temperature in hyperthermic patients with stroke.	I	C-LD	Recommendation and COR unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.
Additional support for this recommendation unchanged from the 2013 AIS Guidelines is provided by a large retrospective cohort study conducted from 2005 to 2013 of patients admitted to intensive care units in Australia, New Zealand, and the United Kingdom. Peak temperature in the first 24 hours <37°C and >39°C was associated with an increased risk of in-hospital death compared with normothermia in 9366 patients with AIS.[133]			See Tables XXXI and XXXII in online Data Supplement 1.
2. In patients with AIS, the benefit of treatment with induced hypothermia is uncertain.	IIb	B-R	Recommendation revised from 2013 AIS Guidelines.
To date, studies of hypothermia in AIS show no benefit in functional outcome and suggest that induction of hypothermia increases the risk of infection, including pneumonia.[134–137] These studies use a variety of methods to induce hypothermia and are small/underpowered, meaning that a benefit for hypothermia in AIS cannot be definitively excluded. A large phase III trial of hypothermia in AIS is ongoing.			See Tables XXXIII and XXXIV in online Data Supplement 1.

3.4. Blood Glucose

3.4. Blood Glucose	COR	LOE	New, Revised, or Unchanged
1. Hypoglycemia (blood glucose <60 mg/dL) should be treated in patients with AIS.	I	C-LD	Recommendation and COR unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.
2. Evidence indicates that persistent in-hospital hyperglycemia during the first 24 hours after AIS is associated with worse outcomes than normoglycemia, and thus, it is reasonable to treat hyperglycemia to achieve blood glucose levels in a range of 140 to 180 mg/dL and to closely monitor to prevent hypoglycemia in patients with AIS.	IIa	C-LD	Recommendation and COR unchanged from 2013 AIS Guidelines. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System.

Section 1: Recommendations[a]

[a]These recommendations provide guidance in the management of spontaneous intracerebral hemorrhage (ICH), not hemorrhagic conversion of an ischemic infarction; These recommendations may not be applicable to ICH of secondary causes; These recommendations should be referred to once a confirmed diagnosis of ICH has been established following brain imaging; Prior to diagnosis of ICH, follow the Initial assessments and imaging guidelines defined in the CSBPR Acute Stroke Management module 2018 (Sections 2, 3, 4) for all patients who arrive at hospital with a suspected stroke and during prehospital management.

1.0. Intracerebral hemorrhage should be treated as a medical emergency. When intracerebral hemorrhage is suspected (or confirmed), patients should be evaluated urgently (Evidence Level B) by physicians with expertise in acute stroke management (Evidence Level C).

Note: For patients presenting in community or rural hospitals, Telestroke modalities could facilitate rapid access to stroke expertise for consultation and decision-making regarding transfer to a higher level of care.

1.1. Initial clinical assessment of intracerebral hemorrhage

i. A severity score based on neurological exam findings should be conducted as part of the initial assessment (Evidence Level B). The National Institute of Health Stroke Score is preferred for awake or drowsy patients or a Glasgow Coma Scale (GCS) in patients who are obtunded, semi or fully comatose (Evidence Level C).

Note: The GCS has been found to be a strong predictor of outcomes following ICH.

a. Patients with declining GCS and/or equal to less than 8 should be rapidly assessed for airway support by endotracheal intubation (Evidence Level B).
b. Patients with reduced level of consciousness (LOC), pupillary changes, and/or other signs of herniation should have temporizing maneuvers to manage presumed elevation in ICP, such as temporary hyperventilation, and hyperosmotics (e.g. mannitol or 3% saline) (Evidence Level C).

ii. Patients with suspected ICH should undergo CT immediately following stabilization to confirm diagnosis, location, and extent of hemorrhage (Evidence Level A). *Refer to CSBPR Acute Stroke Management module for additional information on initial brain imaging. www.strokebestpractices.ca.*
iii. In patients with confirmed acute ICH, intracranial vascular imaging is recommended *for most patients* to exclude an underlying lesion such as an aneurysm or arteriovenous malformation or cerebral sinus venous thrombosis (Evidence Level B).
   a. Factors that increase the yield of angiography include age <50 years, female sex, lobar, or infratentorial location of ICH, accompanying intraventricular hemorrhage, absence of neuroimaging markers of cerebral small vessel disease, and/or absence of hypertension or impaired coagulation (Evidence Level B).
   b. Where suspicion is high for an underlying vascular lesion, the vascular imaging should be performed at the same time as brain imaging (Evidence Level C).
iv. Evaluation of patients with acute ICH should include questions about medication history (Evidence Level C) and antithrombotic therapy, measurement of platelet count, partial thromboplastin time, and international normalized ratio (Evidence Level A).
v. Patients should be assessed for clinical signs of increased ICP such as pupil reaction and LOC (Evidence Level B).
vi. A GCS score and neurovital signs should be conducted at baseline and repeated at least hourly for the first 24 h, depending on stability of patient (Evidence Level C).
vii. If physicians with expertise in acute stroke management are not available onsite, protocols should be in place to contact appropriate experts through virtual telestroke technology (Evidence Level B) to expedite patient assessment and decisions regarding transport to a higher level of care (Evidence Level C).

Clinical considerations for Section 1.1

i. The resolution of CT angiography is preferred over MR angiography when screening for underlying vascular anomalies.
ii. Clinical signs of increased ICP include reduced LOC, dilated unresponsive pupils, new cranial nerve VI palsies, or other false localizing neurological signs, worsening headache and/or nausea/vomiting, and elevated blood pressure with reduced heart rate and irregular/decreased respirations (Cushing's reflex).
iii. Potential unstable patients requiring greater monitoring frequency (i.e. neurovital signs hourly for first 24 h) include patients with large (>30 cc) ICH volume, depressed or declining GCS (<12), worsening neurological disability, infratentorial location, associated intraventricular hemorrhage or hydrocephalus, refractory hypertension, and/or neuroimaging markers of ICH expansion (see Section 1.5).
iv. The use of tranexamic acid has been shown to be safe in a large phase 3 trial (TICH-2) but there was no effect on the primary outcome of functional status at 90 days. Post-hoc pre-specified subgroup analyses showed better functional status in patients with baseline SBP less than 170 mm Hg. However, this post-hoc finding has yet to be confirmed. Overall, the clinical role of tranexamic acid for spontaneous ICH remains unclear, and there is no evidence for its use in the setting of anticoagulant-related ICH.

1.2. Blood pressure management

i. Blood pressure should be assessed on initial arrival to the Emergency Department and every 15 min thereafter until desired blood pressure target is achieved and maintained for the first 24 h (Evidence Level C).
ii. SBP lowering to a target of <140 mm Hg systolic does not worsen neurological outcomes (relative to a target of 180 mm Hg systolic) (Evidence level A); however, clinical benefit has yet to be established (Evidence level A).
iii. Subsequent blood pressure monitoring should be tailored to the individual patients according to stability of the vital signs and ICP (Evidence Level C).
iv. There is a lack of strong evidence to guide choice of initial blood pressure lowering agents.

Clinical consideration for Section 1.2

i. A SBP threshold at an individual target of less than 140–160 mm Hg for the first 24–48 h post-ICH may be reasonable.
   a. Factors that may favor a lower target within this range (i.e. <140 mm HG) may include: presentation within 6 h of symptom onset; presenting SBP no greater than 220 mm Hg; anticoagulation therapy; presence of neuroimaging markers of expansion (see Section 1.5) and/or normal renal function.
ii. Parenteral labetalol, hydralazine, nicardapine, and/or enalipril (oral or intravenous) may be considered for acute blood pressure reduction.

Pharmacological correction of severe hypertension (blood pressure >180/105 mm Hg) is recommended in the acute phases of ICH, with the goal being maintenance of normal cerebral perfusion pressure levels on the order of 50–70 mm Hg. Current evidence is unclear regarding whether further reduction of systolic blood pressure to less than 140 mm Hg improves clinical outcomes

However, rapid reduction to below this target with the use of IV nicardipine in acute ICH patients presenting with systolic blood pressures above 180 mm Hg has been shown to increase the risk of acute kidney injury

Most experts aim to keep the systolic blood pressure at various individual targets less than 160 mm Hg for the first 24–48 hours following ICH. Given the totality of current literature, a target of less than 140 mm Hg seems reasonable, where such a target would not result in greater than an 60 mm Hg absolute reduction in their presenting systolic blood pressure (i.e. presenting systolic blood pressures <200 mm Hg).

Choice of antihypertensive agent may be important. IV labetalol or nicardipine may provide smooth onset of action and allow physicians to control blood pressure in patients without cardiac contraindications to these agents

Labetalol is begun as 10–20 mg IV push over 1–2 minutes. Doses can be increased up to 20–80 mg every 10-15 minutes, or a continuous infusion starting at 0.5–2 mg/minute can be used if needed. The maximum dose is 300 mg/day.

Nicardipine infusions are begun at 5 mg/h. The dose can be increased by 2.5 mg/h at 5–15 minute intervals. The maximum dose is 15 mg/h

Nitrates theoretically may worsen cerebral edema owing to their vasodilatory properties and have traditionally been avoided, given the other available agents. However, this concern may need to be reconsidered based on more recent clinical trial data.

The Efficacy of Nitric Oxide in Stroke (ENOS) trial investigated the safety and efficacy of reducing blood pressure using transdermal glyceryl trinitrate given within 48 hours of an ischemic stroke or ICH. In a subgroup analysis restricted to ICH, glyceryl trinitrate was safe in the overall population but did not improve functional outcomes at 90 days. There was a possible functional outcome benefit among the 61 patients randomized to treatment within 6 hours, although this result requires confirmation given the small sample and limitations of subgroup analyses

Management of anticoagulation

i. Patients presenting with anticoagulant-related ICH should have their anticoagulation withheld and should be considered for immediate reversal, irrespective of the underlying indication for anticoagulation (Evidence Level B).
ii. Beyond initial investigations, further management should be tailored to the specific antithrombotic agent used (Evidence Level C).
iii. Warfarin should be reversed immediately with PCC dosed as per local protocols and in conjunction with intravenous Vitamin K 10 mg (Evidence Level B).
iv. For patients on direct oral anticoagulants (DOACs), most information about anticoagulation activity would come from establishing time of last dose, creatinine clearance, anti-factor Xa level, if available (Evidence Level C).

Note: Reversal should not be delayed while waiting for laboratory results, rather it should be based on clinical history.

v. Factor Xa inhibitors (apixaban, edoxaban, rivaroxaban) should be stopped immediately and PCC administered at a dose of 50 U/kg with a *maximum* dose of 3000 U (Evidence Level C).

Note: There are no targeted anti-Factor Xa reversal agents available in Canada at this time.

vi. Dabigatran should be stopped immediately and reversed with idarucizumab; patients should be given a total dose of 5 g, in two intravenous bolus doses of 2.5 g each, given no more than 15 min apart (Evidence Level B).

Note: The doses should be given successively. There is no requirement for time delay between doses.

a. If idarucizumab is not available, use of FEIBA (anti-inhibitor coagulant complex; activated PCC) is recommended at 50 U/kg to a maximum of 2000 U (Evidence Level C).
b. If both agents are not available, consider four-factor PCC at a dose of 50 U/kg to a *maximum* dose of 3000 U (Evidence Level C).

vii. If the patient has received therapeutic low molecular weight heparin (LMWH) within the past 12 h, consider administering protamine (Evidence Level C).

viii. If the patient is receiving intravenous heparin infusion at the time of ICH, infusion should be immediately discontinued and consider administering protamine (Evidence Level C).

ix. Antiplatelet agents (e.g. acetylsalicylic acid (ASA), clopidogrel, dipyridamole/ASA, and ticagrelor) should be stopped immediately (Evidence Level C).

x. Platelet transfusions are not recommended (in the absence of significant thrombocytopenia) and may be harmful (Evidence Level B).

TABLE 1 Medical Hemostatic Therapies In Intracerebral Hemorrhage

Coagulopathy	Specific agent	Half-Life	Strategy for Reversal/Compensation	Cautions
Vitamin K antagonist	Warfarin	20-60 h	• Vitamin K repletion • Fresh frozen plasma 4 U or 12 ml/kg. • Prothrombin complex concentrate (PCC) preferred to fresh frozen plasma when available. • K-Centra dosing (other PCCs dosed similarly) if INR 1.7-<4, give 25 U/kg (max 2,500 U) if INR 4-6, give 35 U/kg (max 3,500 U) if INR >6, give 50 U/kg (max 5,000 U)	• Vitamin K injection can cause anaphylaxis • PCCs associated with thrombosis including DIC
Heparinoids	Unfractionated heparin Dalteparin	60 min 4.5 h	• For heparin, stop infusion, if PTT prolonged, administer protamine sulfate 1 mg per 100 U heparin given in the prior 3 h, administer slowly to avoid paradoxical anticoagulant effect • Dalteparin reversible with protamine: dose 1 mg/100 antiXa IU dalteparin in prior 8 h	• Protamine may cause bradycardia, hypotension
Factor Xa inhibitors	Apixaban Rivaroxaban Edoxaban Fondaparinux	8 h 5-13 h* 10-14 h 17-21 h*	• Andexanet-alfa, studied for reversal of apixaban, rivaroxaban, edoxaban, and enoxaparin: 400 mg bolus over 15 min, then 480 mg over 2 h† • PCCs often used to compensate for these agents after ICH, but use is off-label and has unproven efficacy	• Andexanet-alfa associated with thrombotic events.
Direct thrombin inhibitors	Dabigatran Argatroban Bivalirudin	14-17 h 45 min 25 min	• Idarucizumab (humanized Fab fragment) reverses dabigatran: given in single 5 g/100 ml dose, repeated if needed. Not known to be effective on other agents. • Activated charcoal if ingested within 1-2 h • Can dialyze dabigatran if reversal agent is not available	• Idarucizumab associated with headaches
Fibrinolysis	tPA Tenecteplase	5 min, 12 h until fibrinogen level recovery	• Within 36 h, transfuse cryoprecipitate 10 units, additional units as needed to normalize fibrinogen level (>150 mg/dl) • Aminocaproic acid, 4 g in first hour, then 1 g/h for 8 h OR • Tranexamic acid, 10 mg/kg 3 times/day	• Cryoprecipitate may cause thrombotic events, including DIC, transfusion-related lung injury
Antiplatelet therapy	Aspirin Clopidogrel Ticagrelor Dipyridamole		• Hold medication • Platelet transfusion or other pharmacological reversal strategies generally NOT needed. PATCH trial found trend toward worse outcomes with platelet transfusion.	
Uremic platelet dysfunction	BUN >80		• May try desmopressin 0.3 µg/kg in 50 ml. Limited evidence for efficacy in ICH, but well-established in other pathological bleeding settings	May cause tachycardia, headache
Thrombocytopenia	Platelet count <50 to 100		• Transfuse platelets to achieve platelet count >50,000/µl (a higher threshold up to 100,000/µl may be needed if neurosurgical intervention planned)	May contribute to volume overload
Factor deficiencies			• PCC (particularly FEIBA), FFP, or cryoprecipitate, depending upon the specific deficiency • Desmopressin for von Willebrand disease, 0.3 µg/kg diluted in 50 ml	Thrombosis
Moral opposition to blood products			• The best alternative in most cases is to use aminocaproic acid or tranexamic acid. They reduce ICH expansion, but have equivocal effect on functional outcome.	

2.3. Increased intracranial pressure (ICP)

i. In cases of suspected elevated ICP, conservative methods to decrease ICP (such as elevation of head of bed 30°, methods of neuroprotection (e.g. euthermia and euglycemia), analgesia, and mild sedation) are reasonable (Evidence Level C).
ii. In the absence of concerns regarding ICP, head of bed positioning does not seem to influence neurological outcomes or serious adverse events in stroke patients, including ICH (Evidence Level B).
iii. There is insufficient evidence to recommend the routine or prophylactic use of hyperosmotic agents in ICH (Evidence Level C).
    a. Hyperosmotic agents (mannitol and/or 3% normal saline) can be considered as a temporizing measure to decrease ICP in ICH patients with clinical signs of herniation prior to surgical intervention (Evidence Level C).
iv. Use of corticosteroids to treat ICP in ICH may cause harm, has no proven benefits, and therefore is not recommended (Evidence Level B).

Clinical considerations for Section 2.3

i. Hyperthermia and hyperglycemia have been associated with poor outcomes in ICH patients. In the absence of randomized controlled trial research evidence, it is advisable to target normothermia and normoglycemia in hospitalized ICH patients.
ii. In patients with elevated ICP ensure to avoid compression of neck vessels, particularly when securing endotracheal tubes.

1.4. Consultation with neurosurgery

i. Neurosurgical consultation can be considered as a life-saving intervention for large ICH that is surgical accessible or causing obstructive hydrocephalus. Smaller non-life-threatening ICH requires stroke unit care and does not necessarily require neurosurgical consultation (Evidence Level C).

Note: If neurosurgical services not available onsite, initial consultation should be initiated with nearest neurosurgical services without delay, using telephone or Telemedicine technology.

Clinical consideration for Section 1.4

i. Participation and enrollment in randomized trials should be considered where possible.

1.6. Surgical management of ICH

i. External ventricular drainage (EVD) should be considered in patients with a reduced LOC and hydrocephalus due to either intraventricular hemorrhage or mass effect (Evidence Level B).

ii. Surgical evacuation is not recommended if symptoms are stable and there are no signs of herniation (Evidence Level B).
   a. Intraventricular thrombolysis to treat spontaneous intraventricular hemorrhage with or without associated ICH is generally not recommended (Evidence Level B). Treatment may reduce the risk of death but does not increase the chances of survival without major disability (Evidence Level B).

iii. Acute surgical intervention may be considered in patients with surgically accessible supratentorial hemorrhages and clinical signs of herniation (e.g. decreasing LOC, pupillary changes) (Evidence Level C), particularly in the following subgroups:
   a. Young patients (<65 years of age)
   b. Superficial ICH location (less than or equal to 1 cm from the cortical surface)
   c. Associated vascular or neoplastic lesion

iv. Patients with cerebellar hemorrhage may be considered for neurosurgical consultation, particularly in the setting of altered LOC, new brainstem symptoms, or diameter of 3 or more cm (Evidence Level C).
   a. EVD placement should occur in conjunction with hematoma evacuation in the setting of concurrent hydrocephalus (Evidence Level C).

v. The clinical benefit of minimally invasive clot evacuation is yet to be established.
   a. Routine use of stereotactic thrombolysis and drainage (MISTIE technique (tPA)) is not recommended based on current evidence (Evidence Level B).

Clinical considerations for Section 1.6

i. Patients with significant hydrocephalus and normal LOC should be monitored closely and could be considered for EVD at earliest signs of decreasing LOC.
ii. Intraventricular thrombolysis to treat spontaneous intraventricular hemorrhage with or without associated ICH may reduce the risk of death but seems to increase the chances of survival with major disability.
iii. Based on the findings of one RCT (MISTIE III), stereotactic thrombolysis appears to be safe and reduces mortality compared to medical management alone but does not improve functional outcomes. Successful hematoma volume reduction to <15 mL may be associated with functional outcome benefit.
iv. Endoscopic evacuation of deep and superficial ICH also decreases hematoma volume. Small randomized and non-randomized series have suggested benefit. The impact on functional outcomes is currently under assessment in larger randomized clinical trials.
v. Endoscopic evacuation without the use of thrombolysis is under ongoing investigations. Its routine use is not recommended outside the framework of a clinical trial.
vi. Confirmation of anticoagulation reversal should be obtained intraoperatively.
vii. Pneumatic compression devices should be placed preoperatively and maintained post operatively until pharmacologic DVT prophylaxis can be initiated.