

1. Introduction and Who Guideline applies to

Non-traumatic subarachnoid haemorrhage (SAH) has a range of causes: 85% are due to ruptured aneurysms, requiring early interventional treatment. 10% are perimesencephalic and managed conservatively. The remaining 5% are caused by rare conditions, including cerebral amyloid angiopathy, reversible cerebral vasoconstriction syndrome (RCVS) and arteriovenous malformations (AVMs).

The sensitivity of CT for SAH decreases as time from the onset of headache to imaging elapses. Since a delay in diagnosis of aneurysmal SAH (aSAH) can be associated with poorer patient outcomes, many guidelines recommend that lumbar puncture (LP) should be considered after a negative CT if more than 6 hours have passed between symptom onset and CT - a position recently also repeated by NICE. [1] Yet in reality, SAH is most often missed when clinicians do not consider the diagnosis (for instance, by looking only for the 'classic' history of thunderclap headache and disregarding high-risk features such as diplopia or a family history of intracranial aneurysms) and therefore fail to request imaging rather than when not performing LP, which has considerable undesirable effects of its own.

The more differentiated approach to LP described in this document was developed and validated collaboratively by a group of UHL clinicians. It places the role of LP in the context of post-test (i.e. post-CT) probability of aneurysmal SAH (a function of time passed from the onset of headache to imaging), key high-risk criteria and a minimum haematocrit allowing the detection of blood on CT. Full details of our study involving 712 patients, the validity of which remains unaffected by NICE guideline NG228, are available on [EM3](#). [2]

This guideline describes the investigation of suspected SAH in neurologically intact adults presenting to hospital and the initial management of patients with imaging-confirmed SAH, including neurosurgical referral. It applies to all UHL staff involved in the care of such patients. Traumatic SAH (tSAH) falls outside the scope of the guideline, since its pathology and management are distinctly different. Of note, traumatic SAH should always be referred to by its full name to avoid the risk of miscommunication that could lead to inappropriate management.

2. Guideline Standards and Procedures

2.1 Initial clinical assessment and patient selection for CT head

- Assessment should follow the algorithm shown in [Appendix A](#) (page 3)
- Emergency Department (ED) clinicians should use the [ED acute headache guideline](#) (proforma), [3] which uses the same algorithm but also considers additional indications for imaging and differential diagnoses (**NB**: Proforma may also be used elsewhere)

2.2 SAH diagnosed on CT

- Patients should be managed as outlined in algorithm shown in [Appendix B](#) (page 4)
- Referrals to the neurosurgical team at NUH using [Referapatient](#) should be made as per the online referral form completion guide for SAH shown in [Appendix C](#) (page 5)

2.3 Further management of CT negative patients

- The algorithm shown in [Appendix D](#) (page 8) should be followed
- Patients at low risk of aSAH should be given the Information for Patients sheet '[Lumbar puncture to rule out a bleed on the brain after a normal CT head scan](#)' to allow them to participate in the decision-making process regarding LP
- When performing LP
 - The ESM CMG [LP LocSSIP](#) should be followed [4] and samples obtained as described in [Appendix E](#) (page 9)

- An atraumatic (pencil-point) size 22G LP needle should be used to minimise the risk of avoidable headache due to CSF leak [5]
- CSF bilirubin result interpretation by the chemical pathology laboratory will follow the algorithm shown in [Appendix F](#) (page 10) as per national guidance. [6]

3. Education and Training

Clinicians will require support until use of pencil-point tip LP needles has been established. It is anticipated that LP using traumatic needles will be discontinued by April 2024. [7]

4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
Pencil-point tip needles used	Audit	Salam Al-Alousi	Every two years	ESM Q&S board
LPs in patients without risk factors who had CT in < 48h	Audit	Salam Al-Alousi	Every two years	ESM Q&S board

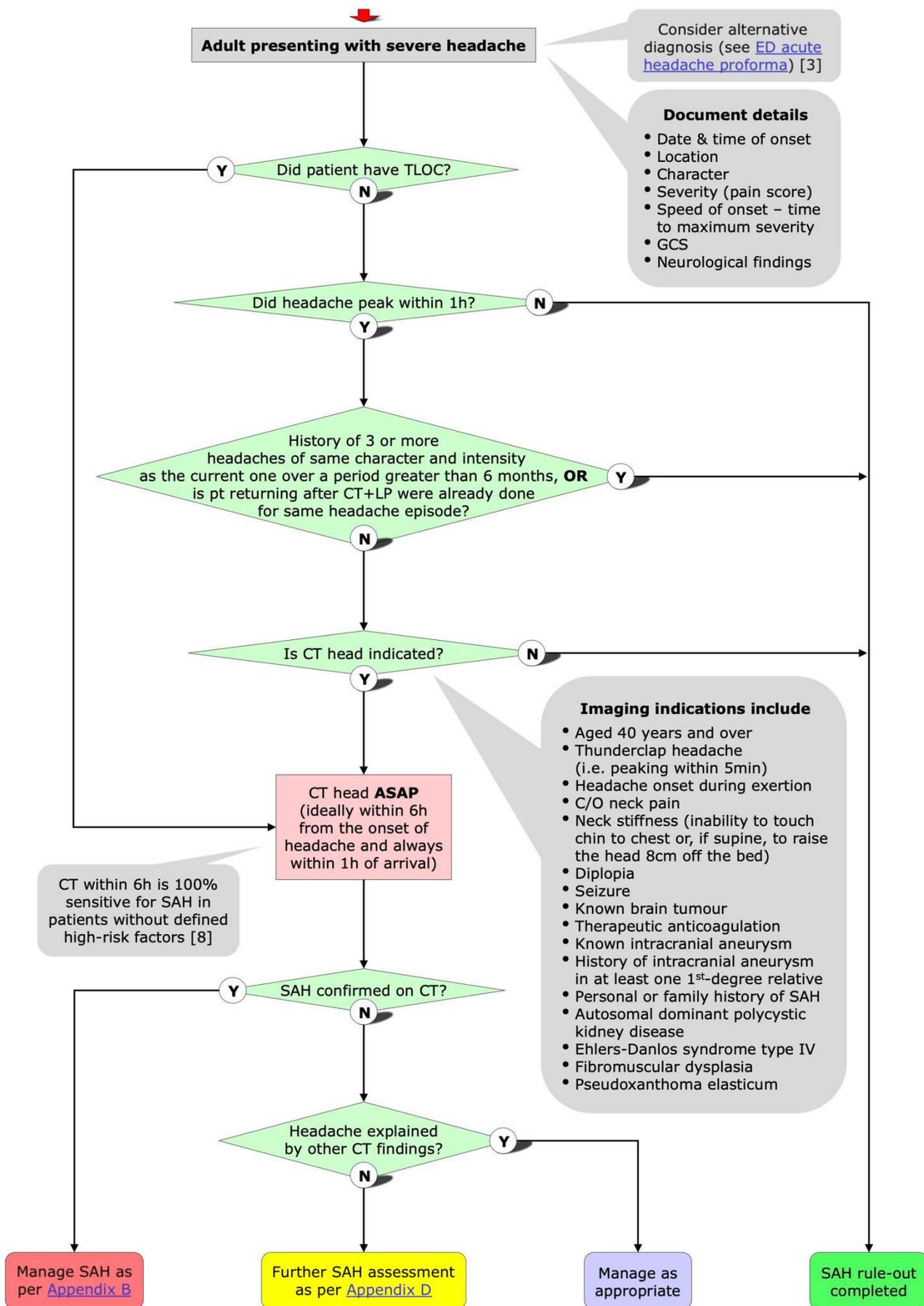
5. Supporting References

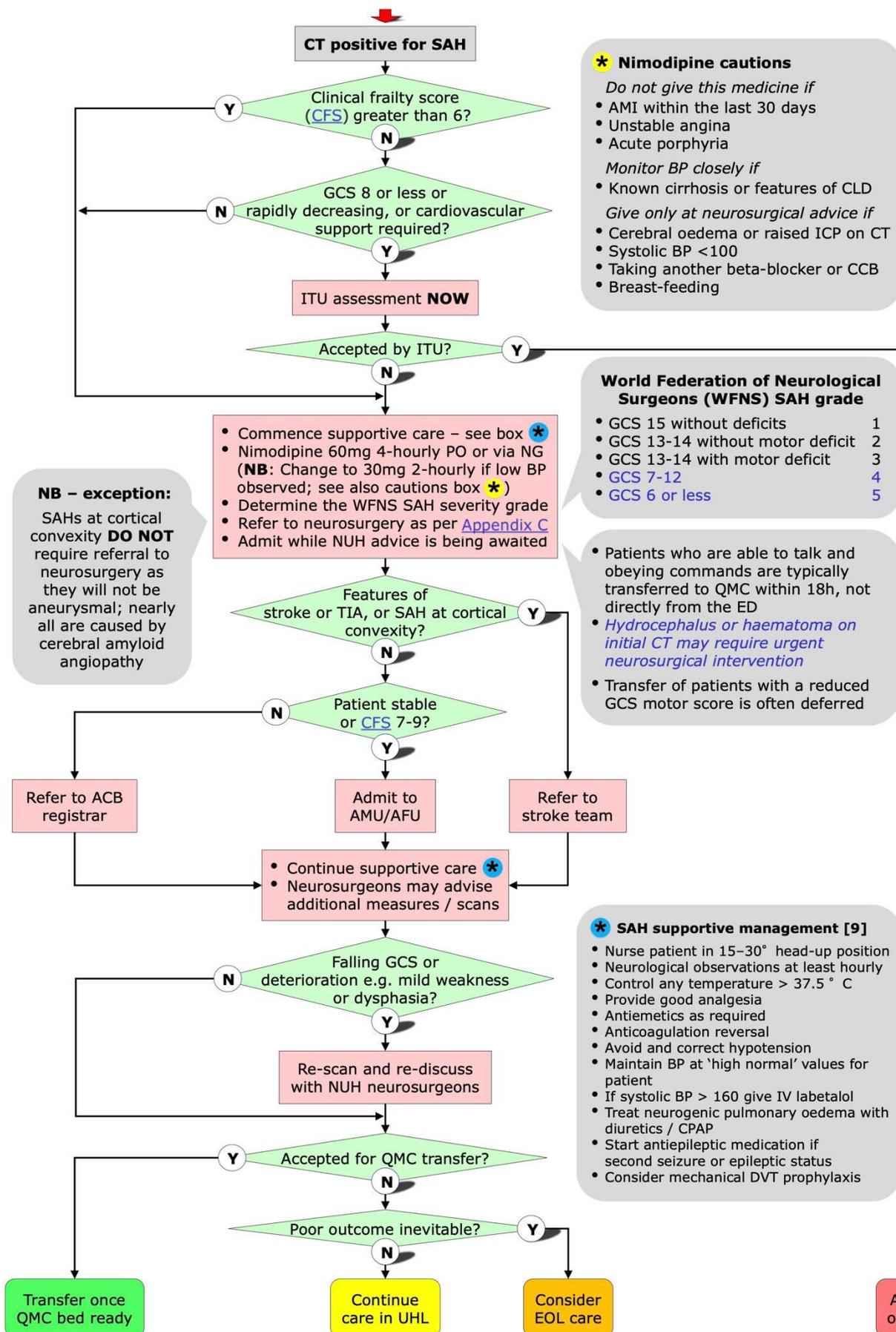
1. NICE (2022) Subarachnoid haemorrhage caused by a ruptured aneurysm: diagnosis and management. [NG228](#). London: National Institute for Health and Care Excellence. (Accessed 24 Jul 2023.)
2. WieseMF. Suspected SAH: Do we still need the needle? EM3. 2015. <https://bit.ly/queryneedle> (Accessed 24 Jul 2023.)
3. WieseMF. [Headache UHL emergency department guideline](#). UHL PAGL. 2018. (Accessed 24 Jul 2023.)
4. Al-AlousiS. [Lumbar Puncture Standard Operating Procedure UHL Emergency and Specialist Medicine LocSSIP](#). UHL PAGL. 2020. (Accessed 24 Jul 2023.)
5. Rochweg B, Almenawer SA, Siemieniuk RAC, et al. Atraumatic (pencil-point) versus conventional needles for lumbar puncture: a clinical practice guideline. *BMJ*. 2018;361:k1920.
6. Cruickshank A, Auld P, Beetham R, et al. Revised national guidelines for analysis of cerebrospinal fluid for bilirubin in suspected subarachnoid haemorrhage. *Ann Clin Biochem*. 2008;45(Pt 3):238–244.
7. Moisset X, Pereira B, Jamet C, Saturnin A, Clavelou P. Specific lumbar puncture training during clinical clerkship durably increases atraumatic needle use. *PLoS One*. 2019;14(6):e0218004.
8. Perry JJ, Stiell IG, Sivilotti ML et al. Clinical decision rules to rule out subarachnoid hemorrhage for acute headache. *JAMA*. 2013;310:1248-55.
9. Wilson SR, Hirsch NP, Appleby I. [Management of subarachnoid haemorrhage in a non-neurosurgical centre](#). *Anaesthesia*. 2005;60(5):470–485. (Accessed 24 Jul 2023.)

6. Key Words

Headache, subarachnoid, haemorrhage, bleed, SAH, aneurysm, rupture, ruptured, CT, lumbar puncture, LP, xanthochromia, cerebrospinal fluid, CSF, arteriovenous malformation, AVM, brain, neurosurgery, neurosurgeons, QMC, Nottingham University Hospitals, NUH, nimodipine

CONTACT AND REVIEW DETAILS	
Guideline Lead (Name and Title) Martin Wiese, Emergency Physician	Executive Lead Andrew Furlong, Medical Director
Details of Changes made during review:	
<ul style="list-style-type: none"> • Prefix '1' added to all telephone extension numbers • Introduction - updated to reflect publication of NICE guideline NG228 in Nov22 [1] • Section 3 - deadline for the discontinuation of traumatic LP needles and new monitoring lead added • Reference 8 - changed to a later publication by the same research group • Two redundant references removed • Appendix A – wording in third decision diamond aligned with the original reference [8] 	





*** Nimodipine cautions**

Do not give this medicine if

- AMI within the last 30 days
- Unstable angina
- Acute porphyria

Monitor BP closely if

- Known cirrhosis or features of CLD

Give only at neurosurgical advice if

- Cerebral oedema or raised ICP on CT
- Systolic BP <100
- Taking another beta-blocker or CCB
- Breast-feeding

NB – exception:

SAHs at cortical convexity **DO NOT** require referral to neurosurgery as they will not be aneurysmal; nearly all are caused by cerebral amyloid angiopathy

- Patients who are able to talk and obeying commands are typically transferred to QMC within 18h, not directly from the ED
- Hydrocephalus or haematoma on initial CT may require urgent neurosurgical intervention
- Transfer of patients with a reduced GCS motor score is often deferred

*** SAH supportive management [9]**

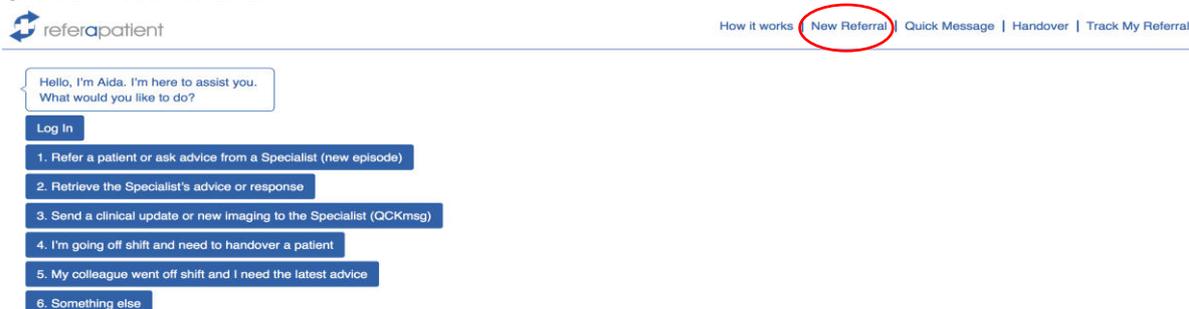
- Nurse patient in 15–30° head-up position
- Neurological observations at least hourly
- Control any temperature > 37.5 ° C
- Provide good analgesia
- Antiemetics as required
- Anticoagulation reversal
- Avoid and correct hypotension
- Maintain BP at 'high normal' values for patient
- If systolic BP > 160 give IV labetalol
- Treat neurogenic pulmonary oedema with diuretics / CPAP
- Start antiepileptic medication if second seizure or epileptic status
- Consider mechanical DVT prophylaxis

How to start

- Go to <https://www.referapatient.org/Home/Index>. If you are a first-time user, you may wish to click on 'How it works' at the top (go through the flowchart; the video is less useful).

(NB: There is no need to create an account, but login details will be sent to you automatically after your first use of the system. A text with a verification code will also be sent to your mobile, which you will need to activate your account.

- Click on 'New Referral'



- Type 'queens m' then hit 'Return'

Queens Medical Centre, Nottingham University Hospitals NHS Trust

- Type 'neuros' then hit 'Return'

Neurosurgery
Neurosurgery MDT Meetings - Internal Use Only

- Click on
- Click on or just hit 'Return'

NB: Hitting 'Return' will usually move you to the next field, but it might also enter a default (e.g. the NHS number '0000000000', and in the gender field) so be careful!
The system will prompt you if fields are mandatory, including right at the end.

Notes on specific fields

- [Medical record number](#)
Copy & paste your patient's S number
- [Contact details of supervising clinician](#)
Only name is required (e.g. consultant on shift or on-call for your area); ignore the rest of the suggested details
- [Patient address](#)
Enter location, e.g. 'LRI ED – Majors' or 'LRI AMU West', extension not required
- [Urgency](#)
Select if there is CT evidence of hydrocephalus. Otherwise, select .
- [Which referral pathway is most relevant?](#)
Select .
- [Working diagnosis](#)
Select .
- [More specifically](#)
Select .
- [What time and date did the event or symptoms occur?](#)
The input field will only appear after the first digit of the day is typed in (e.g. 8 for the 8th of the month). The rest of the field will then autocomplete to the current date and time so you will have to correct the time to the actual time of onset.

Fields 18 to 28 are self-explanatory

29. → [Anticoagulants](#)
Clicking ' ' instead of hitting 'Return' is required here after making your selection
30. → [List of all medications](#)
Unless the patient is taking steroids for a brain tumour, list drug names only
31. → [Neurological examination](#)
Describe any focal neurological signs – e.g. specific limb weakness or cranial nerve deficits. Otherwise, state 'no focal neurological signs'.
32. → [Radiology](#)
Cut and paste report if already available. Leave blank if acute traumatic abnormality is obvious and report not yet available. You can always send it later (see below for details).
33. → [Upload an image or document file](#)
Ignore
34. → [What specific question\(s\) do you want answered?](#)
Questions will usually include
 - Should patient be transferred to QMC?
If yes, where to – i.e. ED, neurosurgical ward, ITU or theatres?
 - What interventions might be required while still at LRI (e.g. nimodipine)?
 - If conservative management at UHL is suggested, what is the proposed treatment plan?
37. → [What is your bleep/ phone number?](#)
Enter a suitable extension
39. → [What is your email address?](#)
Use your UHL email address only
40. → [What is your email clinical supervisor's email address?](#)
This should be the email address of your on-call consultant. **NB:** Leave blank if you do not know it.
41. → [Which Hospital or service provider are you referring from?](#)
Type 'leicester r' and hit 'Return'
42. → [Your Speciality or Service at that Hospital?](#)
Select your speciality then click

After you've hit , the system will display several messages from AIDA. One of them is the referral 'ID key' , which will also be emailed to you. Copy & paste it into the NerveCentre (for ED: 'ED progress notes' field), adding the comment 'Referred to QMC neurosurgeons'.

NB: You can also follow the steps above on your personal smartphone. This might sometimes even be faster (try to dictate text using the microphone button on your smartphone keyboard), although you would not be able to copy & paste imaging reports and other information like you can from a UHL workstation.

Follow-on actions

- You will receive a text (and automated call!) to your mobile once the neurosurgeons have read your referral, and a further one when they have responded. **NB:** To ensure that the right clinician receives those alerts after you have left your shift (and that you are now left in peace), you can use the system to hand over to a named colleague (see below for details).
- The starting point for any further action regarding a referral is to click on 'Track My Referral'



[How it works](#) | [New Referral](#) | [Quick Message](#) | [Handover](#) | [Track My Referral](#)

Hello, I'm Aida. I'm here to assist you.
What would you like to do?

- Copy & paste ID key from NerveCentre (or your email) into the field at the bottom of the page

- Hit 'SEND'. The system will retrieve your referral and present you with several options (the important ones are highlighted and explained below):

Click this to **hand over** and enter the necessary information on the next screen.

Handover

Shift-based referring teams have the option to handover a referral to their successors. Successors can also handover a referral to themselves. All email and SMS alerts will be transferred to the successor.

Your Hospital or Service Provider

Speciality

Name

Grade

Bleep or telephone number

Mobile number for alerts

Email address

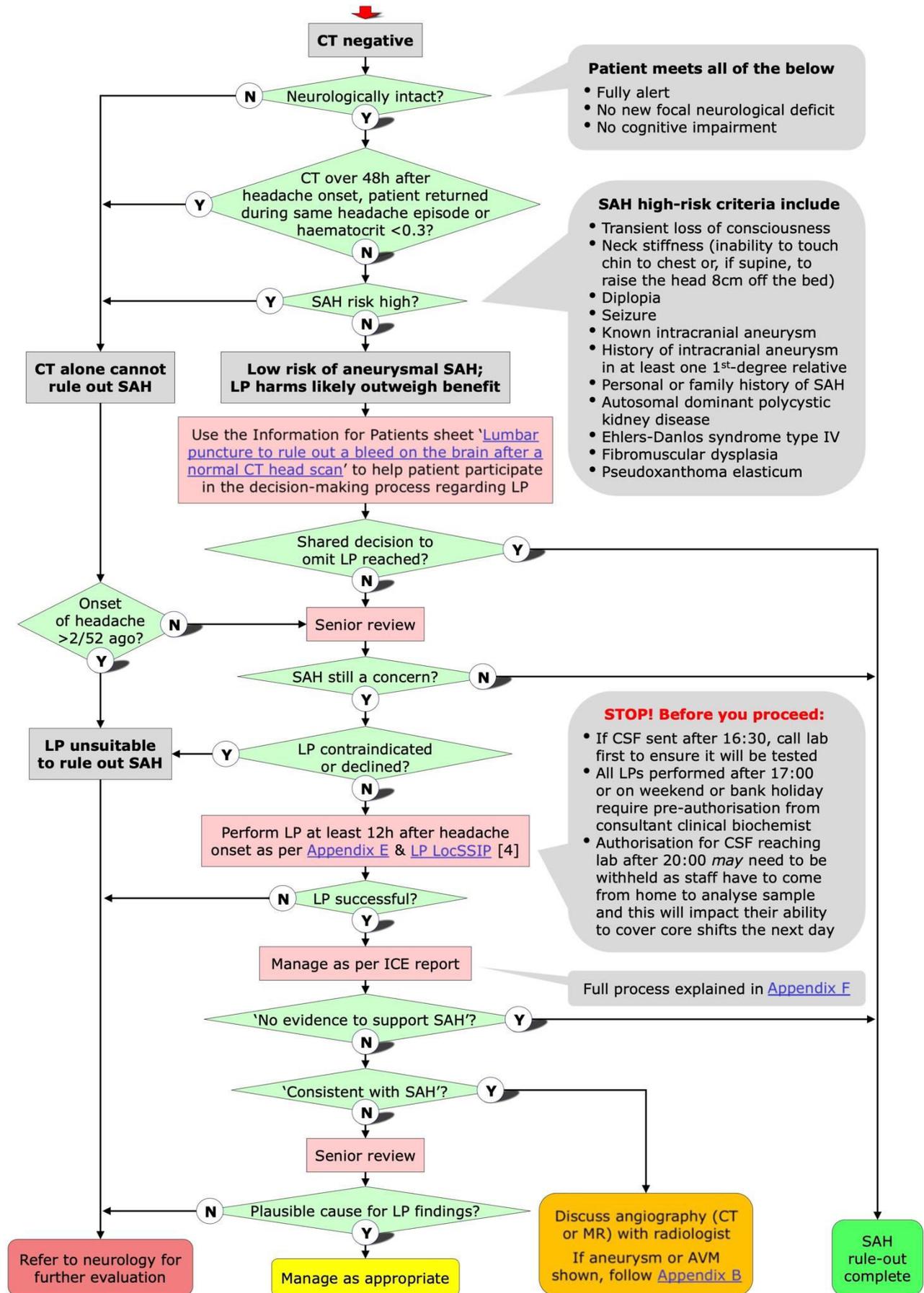
Handover

Click this to **send** additional questions or information (e.g. imaging reports) to the specialist; enter the necessary information into the single box on the next screen

Type or dictate your quick message (QCKmsg) here

Submit Response

Click this to **print** the document – there's a **Print PDF** button at the bottom of the referral. **NB:** Should **ALWAYS** be done once neurosurgical advice received. File referral in patient's record.



1. Complete requests

State test indication, time of symptom onset, time of LP and if differential diagnosis includes meningitis.

If using ICE (three specimen bag labels will be generated)

- CSF samples
 - Search for 'C.S.F.' – tick 'C.S.F. (Chem) profile' (includes glucose and protein)
 - Search for 'CSF' – tick 'CSF (for Microbiology)' and 'Xanthochromia (CSF)'
- Blood samples

Within the 'Pathology' menu, tick 'Liver Function Test', 'Glucose (Plasma)' and 'Total Protein'

If using 'Clinical Microbiology' and 'Combined Haematology / Chemical Pathology Laboratory' forms

- On microbiology form, under 'Fluids', tick 'Culture (Routine)' and write 'Microscopy' under 'Other'
- On combined pathology laboratory form, tick 'Other tests' and write

○ CSF glucose	○ Plasma glucose
○ CSF total protein	○ Serum bilirubin
○ CSF xanthochromia	○ Serum total protein

2. Obtain CSF and blood samples

Perform LP as per LocSSIP [4], obtaining the following CSF and concomitant blood samples:

CSF				Blood
Yellow top fluoride oxalate monovette	White top 28mL universal container	White top 28mL universal container	White top 28mL universal container	Brown top separating gel monovette
				
Number and line up the four required containers as shown				Yellow top fluoride oxalate monovette 
Fill in correct order with the indicated number of drops				
	~0.5mL	~1mL	~1mL	

3. Prepare samples for transport

- Place CSF samples numbered 1 and 2 into the microbiology specimen bag
- Place CSF sample numbered 3 into the special chemistry specimen bag
NB: This bag must be protected from light during transport by placing it in a thick brown envelope.
- Place all of the remaining samples into the combined pathology specimen bag (**NB: If using the old paper request forms, place all chemical pathology samples into one combined pathology lab bag**)

4. Inform both laboratories before delivering samples

- Chemical pathology: Call extension **16561** (alternatives are **16559**, **16560** or **16565**)
- Microbiology
 - During hours: Call extension **16520**
 - Out of hours: Contact Bacteriology Biomedical Scientist on their mobile via switch board

5. Hand-deliver samples to Sandringham Building within 30min of LP

DO NOT use the pneumatic tube system. Deliver samples either yourself or by porter.

The chemical pathology laboratory is located on Level 4; microbiology can be found on Level 5.

