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VST Brain Imaging: a practical guide for Radiographers

The Victorian Stroke Telemedicine Service (VST) is unique within Australia and provides treatment advice and management for patients who present to VST participating hospitals with suspected acute stroke symptoms. The VST service is a virtual system which links participating hospitals to a network of neurologists/stroke specialists who utilise audio-visual technologies and real time access to brain imaging, to facilitate remote clinical consultations.

Hospitals participating in the VST service are provided with a “teledoc” to facilitate remote audio-visual consultations and work is undertaken with the radiology departments to enable images to be pushed to the VST PACS gateway, located in the Ambulance Victoria data-centre in Melbourne.

Up until recently the treatment of ischaemic stroke patients has been limited to within 4.5 hours of symptom onset. There has been much research undertaken to extend this stroke treatment time window. Over the past few years, a number of large clinical trials have demonstrated that patients with large vessel occlusion can benefit from thrombectomy *within 24 hours of symptom onset*.

However, suitable patients in this later time window were principally identified using CT perfusion imaging, with specialised software to measure the volume of the ischemic penumbra and of the infarct core. As a result of these trials, there is now a global push to implement CT perfusion into routine clinical practice. However, acute stroke treatment is time-critical (*“time is brain”*) so it is important that the performance of CTP is rapid and reliable.

As a result, the VST has compiled these key points for the rapid transfer of information to the VST clinical team to enhance access to effective treatment options.

The following is considered the minimum data required for VST:

1. **Non-contrast CT:** this should be the first scan to be performed to search for haemorrhage or any established ischaemic changes.
 - a) Axial 1mm and 5mm
 - b) Reconstructions of sagittal, coronal or thicker images do not need to be sent immediately and should not delay the sending of the first scan.
2. **CT Perfusion:** CTP acquisitions should be between 2-5mm. This thickness reduces image transfer time.
 - a) Please note: **VST does not require the vendor post-processed maps – only the raw CTP data.** VST utilises MiStar software to process the raw CTP imaging [vendor maps have not been validated for ischemic stroke treatment and as such VST avoids using them).
3. **CT Angiogram:** axial CTA ~1mm (anything 0.5-1.5mm is OK) from aortic arch to cerebral vertex (entire brain).
 - a) Post processed images should only be sent once all the core data has been acquired and sent.



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The key point of this guide is that **VST does not require post processed images**. Sending post processed images delays receiving the imaging data on which the clinical decision is based. VST is using a remote, thin client PACS service which processes and streams images for the clinician. Therefore, post processing of most scans is not immediately required and performing post processing should not delay the initiation of an imaging transfer.

Key points:

- **Please do not wait for all scans to be acquired before sending data to VST.** A typical work flow may therefore be: non-contrast CT scan – *push*, then CT Perfusion – *push*, then CT Angio - *push*. All other scans or post processed imaging can be sent once this core data has been received.
- **Imed sites** must code the patient as “**stroke**”. Failing to do delays the transfer of the images and means that the data can take over 2 hours to reach the VST server.
- **Please do not only send the CTP vendor maps.** This data has limited use, as VST requires the original raw dicoms for specialised post processing.
- **Please do not send thick and thin CTP scans**, only one set is required.
- **Head positioning and timing of scans is extremely important.** We do not want a mandible perfusion scan, so if in doubt and there is no support available, here is some general advice:
 - Position patients chin down as far as possible in the headrest and immobilize.
 - Position start of perfusion slab at the superior border of orbits.
 - Ensure post fossa of the brain is included. This may mean lowering the start of perfusion slab.
 - Start position at the base of the pituitary fossa (no need to include foramen magnum) is considered ideal.
 - If the patient moves after the NCCT repeat topogram. Scout image to ensure accurate position of the perfusion slab.
- **Head positioning and duration of CTP scan is important.** CTP scans need to be longer than 30 seconds where 60 seconds is considered ideal. However, the second 30 seconds of a scan should have a slower volume acquisition rate so reduce the radiation dose. If in doubt, please get in contact and we can provide feedback.
- **Spelling does matter.** Most importantly, we continue to experience issues with sites pushing single image series data. The word Stroke needs to be included in the series description with a space at either end. Scans pushed which don't meet these requirements can take 2-4 hours to be received, delaying diagnosis and treatment times.

Radiographers are an absolute cornerstone to the success of the VST service and without their continued support, the VST would not be viable.