= Cerebral venous sinus thrombosis =

Cerebral venous sinus thrombosis (CVST) is the presence of acute thrombosis (a blood clot) in the dural venous sinuses , which drain blood from the brain . Symptoms may include headache , abnormal vision , any of the symptoms of stroke such as weakness of the face and limbs on one side of the body , and seizures . The diagnosis is usually by computed tomography (CT / CAT scan) or magnetic resonance imaging (MRI) employing radiocontrast to demonstrate obstruction of the venous sinuses by thrombus .

Treatment is with anticoagulants (medication that suppresses blood clotting) , and rarely thrombolysis (enzymatic destruction of the blood clot) . Given that there is usually an underlying cause for the disease , tests may be performed to look for these . The disease may be complicated by raised intracranial pressure , which may warrant surgical intervention such as the placement of a shunt .

= = Signs and symptoms = =

Nine in ten people with sinus thrombosis have a headache ; this tends to worsen over the period of several days , but may also develop suddenly (thunderclap headache) . The headache may be the only symptom of cerebral venous sinus thrombosis . Many patients have symptoms of stroke : inability to move one or more limbs , weakness on one side of the face or difficulty speaking . This does not necessarily affect one side of the body as in the more common " arterial " stroke .

40 % of all patients have seizures , although it is more common still in women who develop sinus thrombosis peripartum (in the period before and after giving birth) . These are mostly seizures affecting only one part of the body and unilateral (occurring on one side) , but occasionally the seizures are generalised and rarely they lead to status epilepticus (persistent or recurrent seizure activity for a long period of time) .

In the elderly , many of the aforementioned symptoms may not occur . Common symptoms in the elderly with this condition are otherwise unexplained changes in mental status and a depressed level of consciousness .

The pressure around the brain may rise , causing papilledema (swelling of the optic disc) which may be experienced as visual obscurations . In severely raised intracranial pressure , the level of consciousness is decreased , the blood pressure rises , the heart rate falls and the patient assumes an abnormal posture .

= = Causes = =

Cerebral venous sinus thrombosis is more common in particular situations . 85 % of patients have at least one of these risk factors :

Thrombophilia , a tendency to develop blood clots due to abnormalities in coagulation , e.g. factor V Leiden , deficiency of protein C , protein S or antithrombin , or related problems

Nephrotic syndrome , a kidney problem causing protein loss in the urine

Chronic inflammatory diseases , such as inflammatory bowel disease , lupus and Behçet 's disease

Pregnancy and puerperium (the period after giving birth)

Particular blood disorders , especially polycythemia vera and paroxysmal nocturnal hemoglobinuria

Use of estrogen @-@ containing forms of hormonal contraception

Meningitis and infections of the ear , nose and throat area such as mastoiditis and sinusitis

Direct injury to the venous sinuses

Medical procedures in the head and neck area

Sickle cell anemia

Dehydration , primarily in infants and children

Homocystinuria

= = Diagnosis = =

The diagnosis may be suspected on the basis of the symptoms , for example the combination of headache , signs of raised intracranial pressure and focal neurological abnormalities , or when alternative causes of headache and neurological abnormalities , such as a subarachnoid hemorrhage , have been excluded .

= = = Imaging = = =

There are various neuroimaging investigations that may detect cerebral sinus thrombosis . Cerebral edema and venous infarction may be apparent on any modality , but for the detection of the thrombus itself , the most commonly used tests are computed tomography (CT) and magnetic resonance imaging (MRI) , both using various types of radiocontrast to perform a venogram and visualise the veins around the brain .

Computed tomography , with radiocontrast in the venous phase (CT venography or CTV) , has a detection rate that in some regards exceeds that of MRI . The test involves injection into a vein (usually in the arm) of a radioopaque substance , and time is allowed for the bloodstream to carry it to the cerebral veins - at which point the scan is performed . It has a sensitivity of 75 @-@ 100 % (it detects 75 @-@ 100 % of all clots present) , and a specificity of 81 @-@ 100 % (it would be incorrectly positive in 0 @-@ 19 %) . In the first two weeks , the " empty delta sign " may be observed (in later stages , this sign may disappear) .

Magnetic resonance venography employs the same principles , but uses MRI as a scanning modality . MRI has the advantage of being better at detecting damage to the brain itself as a result of the increased pressure on the obstructed veins , but it is not readily available in many hospitals and the interpretation may be difficult .

Cerebral angiography may demonstrate smaller clots than CT or MRI , and obstructed veins may give the " corkscrew appearance " . This , however , requires puncture of the femoral artery with a sheath and advancing a thin tube through the blood vessels to the brain where radiocontrast is injected before X @-@ ray images are obtained . It is therefore only performed if all other tests give unclear results or when other treatments may be administered during the same procedure .

= = = D @-@ dimer = = =

A 2004 study suggested that the D @-@ dimer blood test , already in use for the diagnosis of other forms of thrombosis , was abnormal (above 500 ?g / l) in 34 out of 35 patients with cerebral sinus thrombosis , giving it a sensitivity of 97 @.@ 1 % , a negative predictive value of 99 @.@ 6 % , a specificity of 91 @.@ 2 % , and a positive predictive value of 55 @.@ 7 % . Furthermore , the level of the D @-@ dimer correlated with the extent of the thrombosis . A subsequent study , however , showed that 10 % of patients with confirmed thrombosis had a normal D @-@ dimer , and in those who had presented with only a headache 26 % had a normal D @-@ dimer . The study concludes that D @-@ dimer is not useful in the situations where it would make the most difference , namely in lower probability cases .

= = = Further tests = = =

In most patients , the direct cause for the cerebral sinus thrombosis is not readily apparent . Identifying a source of infection is crucial ; it is common practice to screen for various forms of thrombophilia (a propensity to form blood clots) .

= = Pathogenesis = =

The veins of the brain , both the superficial veins and the deep venous system , empty into the dural venous sinuses , which carry blood back to the jugular vein and thence to the heart . In cerebral venous sinus thrombosis , blood clots usually form both in the veins of the brain and the

venous sinuses . The thrombosis of the veins themselves causes venous infarction ? damage to brain tissue due to a congested and therefore insufficient blood supply . This results in cerebral edema (both vasogenic and cytotoxic edema) , and leads to small petechial haemorrhages that may merge into large haematomas . Thrombosis of the sinuses is the main mechanism behind the increase in intracranial pressure due to decreased resorption of cerebrospinal fluid (CSF) . The condition does not lead to hydrocephalus , however , because there is no difference in pressure between various parts of the brain .

Any blood clot forms due to an imbalance between coagulation (the formation of the insoluble blood protein fibrin) and fibrinolysis . The three major mechanisms for such an imbalance are enumerated in Virchow 's triad : alterations in normal blood flow , injury to the blood vessel wall , and alterations in the constitution of blood (hypercoagulability) . Most cases of cerebral venous sinus thrombosis are due to hypercoagulability .

It is possible for the clot to break off and migrate (embolise) to the lungs , causing a pulmonary embolism . An analysis of earlier case reports concludes that this occurs in about 10 % of cases , but has a very poor prognosis .

= = Treatment = =

Various studies have investigated the use of anticoagulation to suppress blood clot formation in cerebral venous sinus thrombosis . Before these trials had been conducted , there had been a concern that small areas of hemorrhage in the brain would bleed further as a result of treatment ; the studies showed that this concern was unfounded . Clinical practice guidelines now recommend heparin or low molecular weight heparin in the initial treatment , followed by warfarin , provided there are no other bleeding risks that would make these treatments unsuitable . Some experts discourage the use of anticoagulation if there is extensive hemorrhage ; in that case , they recommend repeating the imaging after 7 ? 10 days . If the hemorrhage has decreased in size , anticoagulants are started , while no anticoagulants are given if there is no reduction .

The duration of warfarin treatment depends on the circumstances and underlying causes of the condition . If the thrombosis developed under temporary circumstances (e.g. pregnancy) , three months are regarded as sufficient . If the condition was unprovoked but there are no clear causes or a " mild " form of thrombophilia , 6 to 12 months is advised . If there is a severe underlying thrombosis disorder , warfarin treatment may need to continue indefinitely .

Thrombolysis (removal of the blood clot with " clot buster " medication) has been described , either systemically by injection into a vein or directly into the clot during angiography . The 2006 European Federation of Neurological Societies guideline recommends that thrombolysis is only used in patients who deteriorate despite adequate treatment , and other causes of deterioration have been eliminated . It is unclear which drug and which mode of administration is the most effective . Bleeding into the brain and in other sites of the body is a major concern in the use of thrombolysis . American guidelines make no recommendation with regards to thrombolysis , stating that more research is needed .

Raised intracranial pressure , if severe or threatening vision , may require therapeutic lumbar puncture (removal of excessive cerebrospinal fluid) , medication (acetazolamide) , or neurosurgical treatment (optic nerve sheath fenestration or shunting) . In certain situations , anticonvulsants may be used to try to prevent seizures . These situations include focal neurological problems (e.g. inability to move a limb) and focal changes of the brain tissue on CT or MRI scan . Evidence to support or refute the use of antiepileptic drugs as a preventive measure , however , is lacking .

= = Prognosis = =

In 2004 the first adequately large scale study on the natural history and long @-@ term prognosis of this condition was reported ; this showed that at 16 months follow @-@ up 57 @.@ 1 % of patients had full recovery , 29 @.@ 5 % / 2 @.@ 9 % / 2 @.@ 2 % had respectively minor /

moderate / severe symptoms or impairments , and 8 @.@ 3 % had died . Severe impairment or death were more likely in those aged over 37 years , male , affected by coma , mental status disorder , intracerebral hemorrhage , thrombosis of the deep cerebral venous system , central nervous system infection and cancer . A subsequent systematic review of nineteen studies in 2006 showed that mortality is about 5 @.@ 6 % during hospitalisation and 9 @.@ 4 % in total , while of the survivors 88 % make a total or near @-@ total recovery . After several months , two thirds of the cases has resolution (" recanalisation ") of the clot . The rate of recurrence was low (2 @.@ 8 %) .

In children with CVST the risk of death is high . Poor outcome is more likely if a child with CVST develops seizures or has evidence of venous infarction on imaging .

= = Epidemiology = =

Cerebral venous sinus thrombosis is rare , with an estimated 3 @-@ 4 cases per million annual incidence in adults . While it may occur in all age groups , it is most common in the third decade . 75 % are female . Given that older studies show no difference in incidence between men and women , it has been suggested that the use of oral contraceptives in women is behind the disparity between the sexes . A 1995 report from Saudi Arabia found a doubled incidence at 7 cases per 100 @,@ 000 ; this was attributed to the fact that Behçet 's disease , which increases risk of CVST , is more common in the Middle East .

A 1973 report found that CVST could be found on autopsy (examination of the body after death) in nine percent of all people . Many of these were elderly and had neurological symptoms in the period leading up to their death , and many suffered from concomitant heart failure .

In children , a Canadian study reported in 2001 that CVST occurs in 6 @.@ 7 per million annually . 43 % occur in the newborn (less than one month old) , and a further 10 % in the first year of life . Of the newborn , 84 % were already ill , mostly from complications after childbirth and dehydration .

= = History = =

The first description of thrombosis of the cerebral veins and sinuses is attributed to the French physician Ribes , who in 1825 observed thrombosis of the saggital sinus and cerebral veins in a man who had suffered from seizures and delirium . Until the second half of the 20th century it remained a diagnosis generally made after death . In the 1940s , reports by Dr Charles Symonds and others allowed for the clinical diagnosis of cerebral venous thrombosis , using characteristic signs and symptoms and results of lumbar puncture .

Improvements on the diagnosis of cerebral venous sinus thrombosis in life were made with the introduction of venography in 1951 , which also aided in the distinction from idiopathic intracranial hypertension , which has similar presenting signs and symptoms in many cases .

The British gynecologist Stansfield is credited with the introduction , in 1942 , of the just recently introduced anticoagulant heparin in the treatment of CVST in 1942 . Clinical trials in the 1990s finally resolved the concern about using anticoagulants in most cases of CVST .

= = Notable cases = =

U.S. Secretary of State Hillary Rodham Clinton was hospitalized on December 30 , 2012 , for anticoagulation treatment of venous thrombosis of the right transverse sinus , which is located at the base of the brain . Clinton 's thrombotic episode was discovered on an MRI scan done for follow @-@ up of a cerebral concussion she had suffered 2 @.@ 5 weeks before after she fell while suffering from gastroenteritis .