Cerebrospinal fluid (CSF) is a clear and colourless liquid, isotonic with and similar in composition to plasma (apart from the fact that it contains only traces of protein). Its total volume in the adult is about 130 ml, of which 30 ml is within the ventricles, 70 ml is in the subarachnoid space surrounding the spinal cord, and the remainder is in the cranial subarachnoid space. It serves to protect the neural tissue of the brain and spinal cord, providing a bath in which the brain floats, and in addition is an important route for the removal of brain metabolites. The ependymal cells lining the choroid plexuses and ventricles have selective transport mechanisms which permit only simple molecules (amino acids and sugars) to reach the brain (blood–brain barrier). CSF circulates around the central nervous system occupying cavities within it and the subarachnoid space around it. CSF is produced mainly by the ependymal cells lining the choroid plexuses of the lateral ventricle but this production is augmented by the smaller choroid plexuses of the third and fourth ventricles and by seepage from the surface of the brain. About 500 ml/day is produced to circulate around the brain and spinal cord but this is constantly reabsorbed. CSF circulates from the lateral ventricles through the interventricular foramina into the third ventricle and then by the aqueduct of the midbrain into the fourth ventricle (Figure 1). It leaves the fourth ventricle through its median and lateral apertures to enter the subarachnoid space near to the pontine cistern. From this space around the base of the brain the fluid ebbas and flows around the spinal cord and brain, descending as far as the lumbar cistern and ascending over the cerebellum, through the tentorial notch to the cerebrum and vault of the skull. The fluid is reabsorbed into the venous system mainly by the arachnoid villi and granulations, which are most prominent in the superior longitudinal sinus. Some fluid is reabsorbed into perineural blood vessels. Arachnoid villi are microscopic projections that invaginate the walls of the cerebral venous sinuses. During infancy, clusters of these villi, especially those lining the superior longitudinal sinus, increase in size to form cauliflower-like clumps, the arachnoid granulations. These granulations increase in size and number throughout life.

The subarachnoid space is thinnest over the cerebral hemispheres but in some areas (where the arachnoid bridges over subdivisions of the brain) wider spaces, cisterns, are formed. The largest of these, the cerebellomedullary cistern (cisterna magna), lies between the cerebellum and posterior surface of the medulla. CSF flows into it from an aperture in the roof of the fourth ventricle. CSF can be obtained from the cisterna magna by midline needle puncture, which passes above the posterior arch of the atlas and through the atlanto-occipital membrane and dura.
Cisternal puncture

This procedure should not be performed if a CSF sample can be obtained by lumbar puncture. However, in trained hands this is a safe procedure because the medulla is more than 2 cm anterior to the posterior occipito-atlantoid ligament.

Technique: the head must be flexed forwards. The patient is usually sitting upright, but it is possible to perform the aspiration with the patient lying on one side. The uppermost cervical spine, that of the axis, is palpated and the aspirating needle is inserted in the midline just above this point. The needle is advanced upwards and forwards parallel to the line joining the external auditory meatus to the nasion (Figure 2). The needle is felt to pierce the posterior atlanto-occipital ligament and enter the cisterna magna 4–5 cm below the skin.