The Hierarchy of Evidence

The Hierarchy of evidence is based on summaries from the National Health and Medical Research Council (2009), the Oxford Centre for Evidence-based Medicine Levels of Evidence (2011) and Melynyk and Fineout-Overholt (2011).

I Evidence obtained from a systematic review of all relevant randomised control trials.
II Evidence obtained from at least one well designed randomised control trial.
III Evidence obtained from well-designed controlled trials without randomisation.
IV Evidence obtained from well designed cohort studies, case control studies, interrupted time series with a control group, historically controlled studies, interrupted time series without a control group or with case- series
V Evidence obtained from systematic reviews of descriptive and qualitative studies
VI Evidence obtained from single descriptive and qualitative studies
VII Expert opinion from clinicians, authorities and/or reports of expert committees or based on physiology

Melynyk, B. & Fineout-Overholt, E. (2011). Evidence-based practice in nursing & healthcare: A guide to best practice (2nd ed.). Philadelphia: Wolters Kluwer, Lippincott Williams & Wilkins.
National Health and Medical Research Council (2009). NHMRC levels of evidence and grades for recommendations for developers of guidelines (2009). Australian Government: NHMRC. http://www.nhmrc.gov.au/_files_nhmrc/file/guidelines/evidence_statement_form.pdf
OCEBM Levels of Evidence Working Group Oxford (2011).The Oxford 2011 Levels of Evidence. Oxford Centre for Evidence-Based Medicine. http://www.cebm.net/index.aspx?o=1025

Databases searched:	☒ CINAHL (Ebsco)	☒ Medline (Ebsco)	☒ Pubmed (NLM)	☐ Nursing (Ovid)	☐ Emcare (Ovid)
Keywords used:	Extra ventricular drain, external ventricular drain, intracranial pressure, ICP, EVD, CSF sampling, cerebrospinal fluid drainage, nursing management, head injury, complications, infection,				
Search limits:					
Other search comments:					

Reference (include title, author, journal title, year of publication, volume and issue, pages)	**Evidence level (I-VII)**	**Key findings, outcomes or recommendations**

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Adelson. P., et al. (2003). Intracranial pressure monitoring. Paediatric Critical Care, 4(3) (suppl.): S28–S30	VII	ICP monitoring is accurately done via external ventricular catheters or from catheter tip pressure transducers. Overall safe practice, clinically significant complications occur infrequently
Alfred Health. (2014). Intracranial Pressure (ICP) Monitoring and Extraventricular Drains.	VII	Alfred Hospital's guideline for the nursing management of a patient with an EVD or ICP monitor, discusses the procedure for safe transportation of a patient with an EVD
Hepburn-Smith, M., Dynkevich, I., Spektor, M., Lord, A., Czeisler, B., & Lewis, A. (2016). Establishment of an External Ventricular Drain Best Practice Guideline: The Quest for a Comprehensive, Universal Standard for External Ventricular Drain Care. The Journal of neuroscience nursing: journal of the American Association of Neuroscience Nurses, 48(1), 54–65. https://doi.org/10.1097/JNN.0000000000000174	VII	In line with the RCH EVD/ICP guideline, this research article highlights the importance of a best practice EVD protocol for catheter insertion, care, and maintenance to reduce ventriculostomy-related infections
Humphrey, E. (2018). Caring for neurosurgical patients with external ventricular drains. Nursing Times, 114(4):52-56.	VII	Discusses the importance of documentation of the prescribed pressure level/height, the importance of frequent observations of CSF output and the importance of preciseness of aligning the EVD transducer to be horizontally level with the tragus of the patient's ear, unless the patient is lying on one side; this anatomical reference point becomes the bridge of the nose. The drainage bag should be changed when it is three-quarters full, as too much weight could disrupt drainage.
Institute for healthcare Improvement. (2012). IHI central Line Bundle: Chlorhexidine Skin Antisepsis.	VII	Using chlorhexidine solution use a back and forth friction scrub at least 30 seconds, and allow the solution time to dry completely, can take up to 2 minutes
Lewis, A., Czeisler, B., & Lord., A. (2017), Variations in Strategies to Prevent Ventriculostomy-Related Infections: A Practice Survey. The Neurohospitalist, 7(1), 15-23. Doi: 10.1177/1941874416663281	VII	Discusses the ideal ranges for CSF specimen collection results for CSF glucose levels, protein, leukocyte levels and their importance as an early indicator for infection.
Medtronic. (2018). Medtronic, exacta TM external drainage and monitoring system quick reference guide. Medtronic Inc.	VII	This document Illustrates how to set up an EVD/ICP including correct positioning, priming and how to adequately use each device.

Muralidharan R. (2015). External ventricular drains: Management and complications. Surgical neurology international, 6(Suppl 6), S271–S274. https://doi.org/10.4103/2152-7806.157620	VI	Studies found that nurses were unable to accurately level an EVD using visual means only, use of a tool such as a carpenter's level/ laser level improved accuracy dramatically. Laser level for EVD height improved patient safety. This document illustrates the steps involved in managing an EVD and obtaining a CSF sample via an EVD; inline with the RCH clinical guideline.
Nag, D. S., Sahu, S., Swain, A., & Kant, S. (2019). Intracranial pressure monitoring: Gold standard and recent innovations. World journal of clinical cases, 7(13), 1535–1553. https://doi.org/10.12998/wjcc.v7.i13.1535	VII	Highlights all methods for measuring ICP with a focus on the utilisation of transducers connected to the extra ventricular drainage, being the gold standard. This article also explains the doctrine proposed by Monroe and Kellie.
O'Connor, Jody, (2019). Great Ormand Street Hospital. External Ventricular Drainage.	VII	Supportive guideline for CSF sampling technique that is current to RCH current practice (not for CSF aspiration by registered nurses). Current method is drop technique; current CSF required is 10 drops/ 1 ml.
Qalab, A., Asad, R., Hakeem,, M., Ahmad, M., Haq, A., Darbar, A. (2016). Paediatric external ventricular drains: experience from a tertiary care hospital of a developing country. JPMA: Journal of Pakistan Medical Association, 66(10), S-72-S-74	VII	Highlights the indications and management of an EVD, CSF drainage systems and their methods and purpose in measuring ICP
Richardson. J., et al. (2012) External ventricular device guideline (EVD). Royal Hospital for Sick Children PICU- Neurosurgery: 1-16	VII	Common indications for raised ICP including head injury, subarachnoid haemorrhage, posterior fossa tumours, acute hydrocephalus and meningitis. Ventricular system anatomy, flow of CSF, secretion and amount discussed. Signs and Symptoms of raised ICP for infants and Children discussed. Procedure documentation with rationale, sampling of CSF from an EVD.
Royal Children's Hospital. (2019). Policies and Procedures; Skin and surgical antisepsis.	VII	RCH hospital guideline on Aseptic Technique, evidence of cleaning practice relates to principles used in cleaning practice of an EVD, and sampling.
Royal Children's Hospital. (2018). Policies and Procedures; Central Venous Access Device Management.	VII	RCH hospital guideline on Central Venous Access Device Insertion and Management, evidence of cleaning practice relates to principles used in cleaning practice of an EVD, and sampling.
Slazinski. T., et al. (2011) Care of the patient undergoing intracranial pressure monitoring/external ventricular drainage or lumbar drainage. American Association of Neuroscience Nurses: 1-37	VII	Discussions on prevention of infection and the strict adherence to aseptic technique required. This literature states the best evidence/data supporting cleaning of EVD ports are from CVAD literature. Lumbar drain devices, equipment and patient assessment

Tavakoli, S., Peitz, G., Ares, W., Hafeez, S., & Grandhi, R. (2017). Complications of invasive intracranial pressure monitoring devices in neurocritical care. Neurosurgical focus, 43(5), E6. https://doi.org/10.3171/2017.8.FOCUS17450	IV	Highlights the importance of intracranial monitoring devices including the indications and complications and the importance of infection prophylaxis.
The Children's Hospital, Weastmead (2017). Intracranial Pressure (ICP) Monitoring via Rickham Resevoir, Codman Monitor or Lumbar Catheter- CHW.	VII	Provides instructions for the monitoring of ICP and zeroing of the Codman monitor. The Codman monitor is currently used to monitor ICP levels within the RCH.
Thompson, D., Vlachos, S., Patel, S., Innocent, S., Tolias, C., & Barkas, K. (2018). Recurrent sampling and ventriculostomy-associated infections: a case-control study. Acta Neurochirurgica, 160(5), 1089-1096. Doi: 10.1007/s00701-018-3508-x	IV	The research findings do not support the notion that increased sampling of EVDs is associated with a higher risk of Ventriculostomy Associated Infection. CSF leaks and long-term EVDs are statistically significant risk factors for infection.
Tippett. N. (2006). Intracranial pressure (ICP) monitoring and extraventricular drains (EVD). Bayside Health, Alfred ICU: 1-19	VII	Documentation on setup and priming of EVD systems, how to zero EVD, with transducer, transporting and positioning of patient. Codman express monitors and its use in ICP monitoring.
Western Health Sydney. (2003). Collection of CSF from a ventricular drain: Intensive care, evidence based practice guideline.	VII	Collection of CSF from a Ventricular Drain, practice and equipment required, cleaning product chlorhexidine 0.5% in alcohol 70% used, to clean access ports on EVD's
Yasuda, T., Tomita, T., McLone, D., & Donovan, M. (2002). Measurement of Cerebrospinal Fluid Output through External Ventricular Drainage in One Hundred Infants and Children: Correlation with Cerebrospinal Fluid Production. Pediatric Neurosurgery, 36(1), 22–28.	III	CSF production rates in developing children and the importance of hourly measurement of CSF through external ventricular drainage (EVD) are covered in this article