**Supplemental Digital Content 1: PRISMA 2009 checklist.**

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| --- | --- | --- | --- |
| **Section/topic** | **#** | **Checklist item** | **Reported on page #** |
| **TITLE** | | |  |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | 1 |
| **ABSTRACT** | | |  |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | 3,4 |
| **INTRODUCTION** | | |  |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | 7 |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | 7 |
| **METHODS** | | |  |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | 7 |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | 7, 8 |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | 7, 8 |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | 7 |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | 7, 8 |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | 8 |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | 8 |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | 8 |
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | 8, 9 |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis. | 9, 45 |

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| --- | --- | --- | --- |
| **Section/topic** | **#** | **Checklist item** | **Reported on page #** |
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | 8 |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | 9 |
| **RESULTS** | | |  |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | 9 |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | 9 |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | 9, 10 |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | 11 |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | 10, 11 |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | 9, 10 |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | 10, 11 |
| **DISCUSSION** | | |  |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | 11 |
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | 17 |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | 17, 18 |
| **FUNDING** | | |  |
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | 18 |

*From:*  Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

**Supplemental Digital Content 2: The Diagnostic Accuracy of Non-invasive Methods to Measure the Intracranial Pressure: an Updated Large-Scale Systematic Review and Meta-Analysis**

**Table S1. Characteristics of the included studies.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Author, year, country | Study design | Sample size | Age\* | Female | Patients' description | Overall risk of bias# |
| Aduayi, 2015, Nigeria3 | Prospective | 160 | Adult | NR | TBI, CVD, tumour, Seizure, tuberculous meningitis, or intracerebral abscess | High |
| Agid, 2006, Canada4 | Retrospective | 86 | 51.8 | 50 | IIH | Low |
| Aiken, 2012, USA5 | Retrospective | 87 | 38 | 69 | IIH | High |
| Albrecht, 2017, Germany6 | Prospective | 48 | 36.4 | 44 | IIH | Low |
| Alperin, 2000, USA7 | Prospective | 17 | Adult | 6 | Intracranial hemorrhage | High |
| Amini, 2013, Iran (a)8 | Prospective | 222 | 42.2 | 77 | TBI or cerebrovascular accident | High |
| Amini, 2013, Iran (b)9 | Prospective | 50 | 37.5 | 26 | Miscellaneous | High |
| Badri, 2012, USA10 | Prospective | 365 | 37 | 85 | TBI | High |
| Bala, 2017, India11 | CS | 100 | 48.7 | NR | TBI, metabolic encephalopathy, RD, COPD, eclampsia, poisoning, or Surgical patients | High |
| Bateman, 2002, Australia12 | Prospective | 24 | 33.5 | 20 | IIH or secondary intracranial hypertension | High |
| Bäuerle, 2011, Germany13 | Prospective | 35 | 40.2 | 19 | IIH | High |
| Beare, 2008, Malawi14 | Prospective | 21 | 5.8 | NR | Acute neurological disease, with and without clinical signs to suggest raised ICP | High |
| Bershad, 2016, USA15 | Prospective | 24 | 31 | 23 | IIH, optic neuritis, seizure, or headache | Low |
| Bialer, 2014, USA16 | Retrospective | 155 | 30.7\*\* | 139 | IIH | High |
| Bicakci, 2006, Turkey17 | Prospective | 32 | 37.3 | 28 | IIH | Low |
| Blaivas, 2003, USA18 | Prospective | 35 | Adult | NR | Intracranial hemorrhage | Low |
| Blank, 1988, Germany19 | Prospective | 20 | 32.2 | 5 | TBI | High |
| Brodsky, 1998, USA20 | Retrospective | 40 | NR | NR | PTC | High |
| Burger, 2009, Germany21 | Prospective | 10 | 45 | 4 | TBI or SAH | High |
| Butros, 2012, USA22 | Retrospective | 92 | Adult | NR | IIH | High |
| Caffery, 2014, USA23 | Prospective | 51 | 39.9 | 28 | Infection, SAH, IIH, multiple sclerosis, ataxia, or papilledema | High |
| Cardim, 2019, UK24 | Prospective | 11 | 47 | 3 | Hypoxic ischaemic brain injury | High |
| Carvalho, 2017, Brazil25 | Retrospective | 63 | 33.4 | 60 | IIH | High |
| Colquhoun, 1989, UK26 | Retrospective | 17 | Adult | NR | TBI | High |
| Degnan, 2011, USA27 | Retrospective | 92 | Adult | 91 | PTC | High |
| del Saz-Saucedo, 2016, Spain28 | Prospective | 30 | 36.5 | 26 | IIH | High |
| Delen, 2018, Turkey29 | Prospective | 48 | 30.4 | 42 | PTC | High |
| Donovan, 1998, USA30 | Retrospective | 12 | 47.1 | NR | Liver cirrhosis and evidence of increased ICP | High |
| Ebraheim, 2018, Egypt31 | Prospective | 54 | 31.5 | 0 | IIH | High |
| Farb, 2003, Canada32 | Prospective | 88 | 52.7 | 49 | IIH | Low |
| Figaji, 2009, South Africa33 | Prospective | 275 | 6.5 | NR | TBI | High |
| Firsching, 2011, Germany34 | Prospective | 102 | 57 | 50 | SAH, tumors, or head injury | Low |
| Frumin, 2014, USA35 | Prospective | 27 | 45.6 | 9 | Hemorrhagic strokes, SAH, TBI, hydrocephalus, or neurocysticercosis | High |
| Galbraith, 1981, Scotland36 | Prospective | 26 | NR | NR | TBI | High |
| Gass, 1996, UK37 | Prospective | 32 | Adult | 24 | IIH | High |
| Geeraerts, 2007, France38 | CS | 62 | 38 | 17 | TBI | High |
| Goel, 2008, India39 | Prospective | 100 | 28 | 28 | TBI | Low |
| Golan, 201340 | Prospective | 24 | 37.8 | 14 | Headache, evaluation for hemiparesis, cognitive deterioration, and seizures | High |
| Görkem, 2015, Turkey41 | Retrospective | 55 | 11.5\*\* | 25 | PTC | High |
| Gupta, 2019, India42 | Prospective | 100 | 60.5 | 19 | Guillian-Barre syndrome, acute pyogenic meningitis, chronic meningitis, cryptococcal meningitis, tuberculous meningitis, febrile encephalopathy, chronic inflammatory polyradiculoneuropathy, SAH, hydrocephalus, viral encephalitis, IIH, demyelination, multiple tuberculomas, seizures, or acute onset headache | High |
| Hamani, 2003, Brazil43 | Prospective | 10 | 56.4 | 3 | Thalamic and ganglionic hemorrhages | High |
| Hanafi, 2019, Iran44 | Prospective | 112 | 32.6 | 26 | TBI | High |
| Hansen, 1994, Germany45 | Prospective | 36 | 48.86 | NR | TBI, SAH, infarction, brain oedema | High |
| Hansen, 1997, Germany46 | Retrospective | 12 | 59.8 | NR | Suspected CSF absorption disorder (communicating hydrocephalus or optic disc elevation of unknown origin) | High |
| Hara, 1998, Japan47 | Retrospective | 55 | 43 | 24 | ICH | High |
| Haredy, 2018, USA48 | Retrospective | 105 | 3.8 | NR | Craniosynostosis | High |
| Hayashi, 1982, Japan49 | Prospective | 17 | 46 | 9 | Supratentorial intracranial tumor, aqueductal stenosis, subdural hematoma, benign intracranial hypertension, superior sagittal sinus thrombosis, and hydrocephalus | High |
| Helmke, 1996, Germany50 | Prospective | 90 | 4.8 | NR | TBI, metabolic disorder | High |
| Heuer, 2004, USA51 | Retrospective | 433 | 51.2 | 278 | SAH | High |
| Higgins, 2004, UK52 | Prospective | 60 | 30 | 51 | IIH | High |
| Hoffmann, 2013, Germany53 | Prospective | 50 | 37.48 | 44 | IIH | High |
| Hukkelhoven, 2005, Netherlands54 | Prospective | 275 | 44.73 | 65 | TBI | High |
| Irazuzta, 2016, USA55 | Prospective | 13 | 14.1 | 10 | IIH | Low |
| Jeon, 2016, South Korea56 | Retrospective | 25 | 65 | 10 | Middle cerebral artery infarction | High |
| Jeon, 2017, South Korea57 | Prospective | 62 | 56.2 | 42 | Intracranial hemorrhage, tumor, abscess, hydrocephalus | High |
| Judy, 2018, USA58 | Prospective | 45 | 2.4 | NR | Craniosynostosis | High |
| Kamel, 2012, USA59 | Retrospective | 57 | 57 | 53 | Intracerebral hemorrhage | High |
| Kerscher, 2019, Germany60 | Prospective | 72 | 5.2 | 22 | Hydrocephalus, craniosynostosis, PTC, TBI, tumor, and other intracranial pathologies with suspected raised ICP, such as cysts or subdural hematoma | Low |
| Kienzler, 2018, Switzerland61 | Prospective | 11 | 52 | 5 | TBI, SAH, or ICH | Low |
| Kimberly, 2008, USA62 | Prospective | 15 | 60 | 5 | TBI, Spontaneous intracerebral hemorrhage | High |
| Kishk, 2018, Egypt63 | Prospective | 134 | 31.2 | 134 | IIH | High |
| Kramer, 2016, Canada64 | Prospective | 644 | 39\*\* | 116 | TBI | Low |
| Lashutka, 2004, USA65 | Prospective | 27 | 59.6 | 12 | Intracranial hemorrhage, tumor, TBI, shunt malfunction, ischemic stroke | Low |
| Le, 2009, USA66 | Prospective | 64 | 8.8 | 24 | Ventriculoperitoneal shunt malfunction, TBI, PTC, posterior fossa mass, cerebral infarction with edema, aqueductal stenosis, bacterial meningitis, or Chiari 1 malformation | Low |
| Lee, 2016, South Korea67 | Prospective | 108 | 63.9 | 27 | Intracranial hemorrhage, tumor, ischemic stroke, hydrocephalus, herniated nucleus pulposus, spinal stenosis, aneurysm, concussion | Low |
| Lee, 2018, South Korea68 | Retrospective | 64 | 63 | 31 | Hydrocephalus | High |
| Li, 2012, China69 | Prospective | 130 | 37 | 56 | Headache, Acroparesthesia, Limbs anergy, Meningitis, convulsion, venous sinus thrombosis, Locomotion disability, diplopia, Language disorders, Loss of memory, limb’s muscle atrophy, facial palsy, mental disorder, bucking during drink, difficult to swallow, heteronomous shaking, paroxysmal neck turning to the side | High |
| Lim, 2010, UK70 | Retrospective | 43 | 8 | 19 | IIH | Low |
| Lim, 2017, Korea71 | Retrospective | 328 | 54.1 | 64 | Subdural hematoma, epidural hematoma, ICH, TBI | High |
| Lingawi, 2010, Saudi Arabia72 | Prospective | 64 | 31.3 | 39 | IIH | High |
| Liu, 2017, China73 | Prospective | 110 | 38.3 | 52 | patients who underwent lumber puncture due to various neurological symptoms or diagnosis | Low |
| Lochner, 2016, Germany74 | Prospective | 42 | 38.9 | 31 | IIH or secondary intracranial hypertension | High |
| Luyt, 2016, South Africa75 | Retrospective | 56 | Adult | NR | Focal neurological signs or a decreased level of consciousness | High |
| Maissan, 2015, Netherlands76 | Prospective | 18 | 38 | 6 | TBI | High |
| Major, 2011, UK77 | Prospective | 26 | 61.5 | 13 | TBI and other not specified acute pathologies | Low |
| Maralani, 2012, Canada78 | Retrospective | 86 | 35.8 | 67 | IIH | Low |
| Marshall, 1983, USA79 | Prospective | 15 | NR | NR | TBI, or IC subdural, or epidural hematoma | High |
| Martin, 2019, France80 | Prospective | 54 | 36.5\*\* | 8 | TBI | High |
| Mehrpour, 2015, Iran81 | CS | 32 | 35.4 | 29 | Pseudopapilledema | High |
| Melo, 2011, France82 | Retrospective | 117 | 7.6 | 34 | TBI | High |
| Miller, 1977, USA83 | Prospective | 160 | NR | NR | TBI | High |
| Moretti, 2009, Italy (a)84 | Prospective | 63 | Adult | NR | SAH, or ICH | Low |
| Moretti, 2009, Italy (b)85 | Prospective | 106 | 55 | 43 | Intracranial hemorrhage | Low |
| Morris, 2017, USA86 | Retrospective | 159 | 33.55 | 130 | IIH | High |
| Muchnok, 2012, USA87 | Prospective | 32 | 41 | 16 | Patients undergoing LP for various neurological problems | High |
| Nabeta, 2014, Uganda88 | Prospective | 98 | 35.5\*\* | 69 | Meningitis | High |
| Nagel, 2009, Germany89 | Prospective | 182 | 51 | 132 | SAH | Low |
| Narayan, 1982, USA90 | Prospective | 207 | 31 | NR | TBI | High |
| Neudorfer, 201191 | Prospective | 37 | 44 | 21 | Papilledema or pseudopapilloedema | High |
| Nirula, 2014, USA92 | Retrospective | 2602 | 42.6 | 642 | TBI | Low |
| O’Brien, 2015, USA93 | Prospective | 36 | 6.6 | 15 | TBI | Low |
| Pace, 2018, Canada94 | Retrospective | 580 | 48.7 | 155 | TBI | Low |
| Padayachy, 2016, South Africa95 | Prospective | 174 | 3 | 52 | Hydrocephalus, TBI, tumour, craniosynostosis, cystic malformation, Chiari I malformation, spinal dysraphism, subdural effusion, or macrocephaly | High |
| Padayachy, 2018, South Africa96 | Prospective | 28 | 30 | 10 | Hydrocephalus, tumor, craniosynostosis, TBI, Chiari I malformation, and spinal lesion | High |
| Patterson, 2018, USA97 | Prospective | 44 | 36.5 | 34 | Patients with papilledema or pseudopapilledema | Low |
| Pellerin, 2018, France98 | Retrospective | 48 | 30.1 | 42 | IIH | High |
| Prunet, 2012, France99 | Prospective | 40 | 49.5 | 9 | TBI, stroke, or SAH | High |
| Qayyum, 2013, UK100 | Prospective | 24 | 56.5 | 9 | TBI | Low |
| Rajajee, 2011, USA101 | Prospective | 65 | 53 | 39 | Intra cranial hemorrhage, TBI, ischemic stroke and brain tumor | Low |
| Rajajee, 2018, USA102 | Retrospective | 27 | 41 | 17 | ALF | High |
| Ranganathan, 2013, USA103 | Prospective | 21 | 29.7 | 21 | IIH | High |
| Rasulo, 2017, Italy104 | Prospective | 38 | 57.8 | NR | TBI | High |
| Razek, 2018, Egypt105 | Prospective | 48 | 30.71 | 41 | IIH | High |
| Ridha, 2013, USA106 | Retrospective | 60 | 37\*\* | 47 | IIH and cerebral venous thrombosis | Low |
| Robba, 2017, UK107 | Prospective | 64 | 53 | 15 | TBI | Low |
| Robba, 2019, UK108 | Prospective | 10 | 8 | 6 | TBI, or ICH | Low |
| Sadhu, 1979, USA109 | Retrospective | 21 | NR | NR | TBI | Low |
| Saindane, 2013, USA110 | Retrospective | 46 | 27.97\*\* | 42 | IIH | High |
| Saindane, 2018, USA111 | Prospective | 18 | 31.05\*\* | 11 | IIH | Low |
| Samuel, 1998, UK112 | Prospective | 40 | 13.3 | 21 | Shunted hydrocephalus | High |
| Sekhon, 2014, UK113 | Retrospective | 57 | 39 | 10 | TBI | High |
| Selhorst, 1985, USA114 | Prospective | 426 | NR | NR | TBI | Low |
| Shirodkar, 2014, India115 | Prospective | 101 | 44.5 | 37 | Fever, headache, vomiting and altered sensorium with possibility of elevated ICP | High |
| Širanović, 2011, Croatia116 | Prospective | 20 | 31 | 2 | TBI | High |
| Soldatos, 2008, Greece117 | Prospective | 76 | 47.6 | 18 | TBI | Low |
| Soliman, 2014, Saudi Arabia118 | Prospective | 40 | 28.9 | 40 | TBI | High |
| Soliman, 2018, Saudi Arabia119 | Prospective | 40 | 37 | 11 | TBI | Low |
| Soustiel, 2010120 | Prospective | 122 | 38.6 | 21 | TBI | High |
| Spentzas, 2010, USA121 | Prospective | 36 | 8.3 | NR | TBI | Low |
| Steinborn, 2016, Germany122 | Prospective | 81 | 11 | 36 | TBI, Hypoxic-ischemic encephalopathy, Tumor/tumor-like process, Infection, Seizure, Migraine/headache, ICH, Infarction/thrombosis | Low |
| Swanson, 2017, USA123 | CS | 79 | 3.9 | 32 | Craniosynostosis, hydrocephalus and suspected intracranial hypertension | High |
| Tabaddor, 1982, USA124 | Retrospective | 36 | Adult | NR | TBI | Low |
| Tayal, 2007, USA125 | Prospective | 59 | 38 | 17 | TBI | High |
| Teasdale, 1984, Scotland126 | Retrospective | 37 | 17 | NR | TBI | High |
| Turkin, 2017, Russia127 | Prospective | 41 | 32 | 11 | TBI | High |
| Vaiman, 2016128 | Retrospective | 443 | 52 | NR | SAH, ICH, or IVH | Low |
| Wakerley, 2015, MC129 | Prospective | 78 | 45.4 | 31 | Suspected meningitis, encephalitis, IIH, or hydrocephalus | Low |
| Wang, 2014, China130 | Prospective | 93 | 54.5 | 14 | TBI, hypertensive brain injury, or surgery for intracranial lesions | High |
| Wang, 2015, China131 | CS | 279 | 41.3 | 122 | Infections, peripheral neuropathy, hydrocephalus, cerebrovascular disease, tumor, primary headache, or epilepsy | High |
| Wang, 2019, China132 | Prospective | 75 | 37 | 21 | TBI | Low |
| Wettervik, 2018, Sweden133 | Retrospective | 609 | 50 | 135 | TBI | High |
| Yuh, 2000, USA134 | Retrospective | 100 | 28.1 | 55 | IIH | Low |
| Zoerle, 2015, Italy135 | Retrospective | 116 | 57 | 86 | SAH | High |
| Zur, 2017136 | Retrospective | 68 | 33 | 61 | IIH | Low |

*Abbreviations; TBI=traumatic brain injury, NR=not reported, IIH=idiopathic intracranial hypertension, SAH=subarachnoid hemorrhage, PTC=* *pseudotumor cerebri, IVH=* *intraventricular hemorrhage, ALF=acute liver failure, LP=lumber puncture, IC=intracranial, CVD=cardiovascular disease, RD=retinal detachment, COPD=chronic obstructive pulmonary disease, MC=multicenter.*

*\*Mean or median as reported by the included study.*

*\*\*This is the mean of two reported values for two groups as reported by the included study.*

*#According to the QUADAS-2 tool recommendations, if a study is judged as “low” on all domains relating to bias or applicability, then it is appropriate to have an overall judgment of “low risk of bias” or “low concern regarding applicability” for that study while If a study is judged “high” or “unclear” in one or more domains, then it may be judged “at risk of bias” or as having “concerns regarding applicability”137.*

**Table S2. Summary of the diagnostic tests.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Author, year, country | Reference test | Diagnostic Test | Definition of raised ICT by standard test | Timing (delay between both tests) |
| Aduayi, 2015, Nigeria3 | CT | US ONSD | sulci effacement, midline shift, dilated ventricles, compression of the ventricles, and compression of basal cisterns | NR |
| Agid, 2006, Canada4 | headache, papilledema (confirmed by an experienced neuroophthalmologist), CSF opening pressure >20 cmH2O, normal CSF constituents, no history of prior condition or medication known to be associated with intracranial hypertension, normal gadolinium- enhanced MRI of the brain, and no evidence of current or prior sinovenous thrombosis. | Empty sella, MRI ONSD, ON enhancement, ON protrusion, ON tortuosity, Pituitary deformity, SF, SLV, Tight subarachnoid spaces | headache, papilledema (confirmed by an experienced neuroophthalmologist), CSF opening pressure >20 cmH2O, normal CSF constituents, no history of prior condition or medication known to be associated with intracranial hypertension, normal gadolinium- enhanced MRI of the brain, and no evidence of current or prior sinovenous thrombosis. | NR |
| Aiken, 2012, USA5 | Clinical diagnosis of IIH with CSF opening pressure >20 cmH2O in nonobese and >25 cmH2O in obese patients | Inferior tonsillar displacement | Clinical diagnosis of IIH with CSF opening pressure >20 cmH2O | NR |
| Albrecht, 2017, Germany6 | Modified Dandy Criteria | Papilledema | Modified Dandy Criteria | NR |
| Alperin, 2000, USA7 | IP | MR-derived ICP | >15 mmHg | NR |
| Amini, 2013, Iran (a)8 | CT | US ONSD | (effacement of sulci, significant edema, midline shifting, and collapse of ventricle(s)) | Immediately after ONSD |
| Amini, 2013, Iran (b)9 | LP | US ONSD | 20 cmH2O | 10 minutes maximum |
| Badri, 2012, USA10 | IP | Decreased Level of Consciousness, PD | >20 mmHg | NR |
| Bala, 2017, India11 | Clinical features and/or radiological findings | US ONSD | The clinical signs and symptoms such as headache, nausea, vomiting, altered sensorium or findings in Computerized Tomography (CT) scan or Magnetic Resonance Imaging (MRI) as reported by radiologist with >five year experience in the field were suggestive of intracranial hypertension. | NR |
| Bateman, 2002, Australia12 | Clinical findings or LP | PI, SS | headache at presentation, with or without visual obscuration; raised CSF pressure (>18 cmH2O); and no abnormalities of CSF composition | NR |
| Bäuerle, 2011, Germany13 | LP | Papilledema, US ONSD | Friedmann 2002 | NR |
| Beare, 2008, Malawi14 | CT | Papilledema, PD, US ONSD | CT signs suggestive of raised ICP included compression of ventricles and effacement of basilar cisterns and cortical sulci, papilloedema, 6th nerve palsy | NR |
| Bershad, 2016, USA15 | LP | TCD | >20 mmHg | Simultaneously |
| Bialer, 2014, USA16 | Modified Dandy criteria | Cephaloceles/Meningoceles Meckel's caves abnormality, Papilledema | Modified Dandy criteria | NR |
| Bicakci, 2006, Turkey17 | All of the patients underwent a thorough neuroophthalmologic and neurologic examination and lumbar puncture for CSF pressure assessment | Empty sella, Papilledema | All of the patients underwent a thorough neuroophthalmologic and neurologic examination and lumbar puncture (ICP was >250 mm in all patients H2O) for CSF pressure assessment | Within 1 hour |
| Blaivas, 2003, USA18 | CT | US ONSD | Midline shift from mass effect of ≥3 mm, collapsed 3rd ventricle, hydrocephalus, effacement of sulci with evidence of substantial edema, abnormal mesencephalic cisterns | Immediately after US |
| Blank, 1988, Germany19 | Epidural pressure transducer | IOP | >15 mmHg | NR |
| Brodsky, 1998, USA20 | Modified Dandy criteria | Empty sella, MRI ONSD, ON enhancement, ON protrusion, ON tortuosity, SF | Elevated ICP signs and symptoms, elevated CSF opening pressure, normal CSF, normal neurologic examination (except 6th nerve palsy), and no hydrocephalus or mass on imaging | NR |
| Burger, 2009, Germany21 | DC | Decreased Level of Consciousness, Marshall Score | >20 mmHg | NR |
| Butros, 2012, USA22 | Modified Dandy criteria | Empty sella, MRI ONSD, ON tortuosity, Papilledema, SF, Widening of FO | Modified Dandy criteria | NR |
| Caffery, 2014, USA23 | LP | US ONSD | >20 cmH2O | NR |
| Cardim, 2019, UK24 | IP | JVP, nICP, US ONSD, TCD, US ONSD | >20 mmHg | NR |
| Carvalho, 2017, Brazil25 | Friedmann 2002 | Papilledema, SS | Friedmann 2002 | NR |
| Colquhoun, 1989, UK26 | IV or epidural transducer | Compression or Absence of Basal Cisterns | >15 mmHg | Immediately after CT scan |
| Degnan, 2011, USA27 | Based on clinical syndrome, papilledema at funduscopic examination, and elevated CSF opening pressure | Meckel's caves abnormality, MRI ONSD, SS | Based on clinical syndrome, papilledema at funduscopic examination, and elevated CSF opening pressure | NR |
| del Saz-Saucedo, 2016, Spain28 | LP | Papilledema, US ONSD | Friedmann 2013 | NR |
| Delen, 2018, Turkey29 | Modified Dandy criteria | Empty sella, Inferior tonsillar displacement, MRI ONSD, ON protrusion, ON tortuosity, SF, SLV, Tight subarachnoid spaces | Modified Dandy criteria | NR |
| Donovan, 1998, USA30 | A cerebrospinal fluid opening pressure or epidural pressure monitor | Motor Posturing | A cerebrospinal fluid opening pressure of >200 mmH2O or sustained epidural pressure measurements >15 mmHg | NR |
| Ebraheim, 2018, Egypt31 | Friedman 2013 | US ONSD | Friedman 2013 | NR |
| Farb, 2003, Canada32 | Headache, papilledema, CSF opening pressure >20 cmH2O, normal CSF constituents, no condition or medication associated with intracranial hypertension, normal brain MRI, and no evidence of sinovenous thrombosis | SS | Headache, papilledema, CSF opening pressure >20 cmH2O, normal CSF constituents, no condition or medication associated with intracranial hypertension, normal brain MRI, and no evidence of sinovenous thrombosis | NR |
| Figaji, 2009, South Africa33 | NR | PI | >20 mmHg | Simultaneously |
| Firsching, 2011, Germany34 | EVD | Venous ophthalmodynamometry | >15 mmHg | Simultaneously |
| Frumin, 2014, USA35 | EVD | US ONSD | >20 mmHg | Within 24 hrs |
| Galbraith, 1981, Scotland36 | IP | Midline shift | NR | NR |
| Gass, 1996, UK37 | IIH symptoms. Confirmation of IIH by elevated CSF opening pressure, imaging and additional diagnostic tests when appropriate | MRI ONSD | IIH symptoms. Confirmation of IIH by elevated CSF opening pressure, imaging and additional diagnostic tests when appropriate | NR |
| Geeraerts, 2007, France38 | IP | Marshall Score, US ONSD | Elevated ICP was defined as ICP of 20 mmHg or higher for >30 minutes during the first 48 hours after injury (before any specific treatment such as hypothermia, mannitol, or DC) | <1 hour |
| Goel, 2008, India39 | CT | US ONSD | Significant cerebral edema, midline shift of ≥3 mm, mass effect, effacement of sulci, collapse of ventricles, compression of cisterns | 15 - 20 minutes |
| Golan, 201340 | LP | IOP | >20 cmH2O | NR |
| Görkem, 2015, Turkey41 | Revised Dandy criteria | Empty sella, MRI ONSD, ON protrusion, ON tortuosity, SF | Proposed diagnostic criteria for prepubertal pseudotumor cerebri (modified from literature) 1) If symptoms or signs present, they may only reflect those of generalized intracranial hypertension or papilledema; normal mental status 2) Documented elevated intracranial pressure (age appropriate) measured in the lateral decubitus position; neonates, >76 mmH2O; age 1–18 years, >280 mmH2O 3) Normal CSF composition except in neonates who may have up to 19 WBC/mm3 if 0–28 days old and up to 9WBC/mm3 if between 29 and 56 days old; the protein may be as high as 150 mg/dl 4) No evidence of hydrocephalus, mass, structural, or vascular lesion on MRI, with and without contrast, and MR venography; narrowing of the transverse sinuses is allowed 5) Cranial nerve palsies allowed if there is no other identifiable etiology and improve with reduction in cerebrospinal fluid pressure or resolution of other signs and symptoms of intracranial hypertension 6) No other identified cause of intracranial hypertension | NR |
| Gupta, 2019, India42 | LP | US ONSD | >20 cmH2O | NR |
| Hamani, 2003, Brazil43 | IV | Decreased Level of Consciousness | >20 mmHg | NR |
| Hanafi, 2019, Iran44 | CT | US ONSD | Midline shifts, ≥3 due to the effect of space‑occupying lesions, third ventricle collapse, hydrocephalus, sulcal effacement with significant edema symptoms, and abnormal mesencephalic cistern | NR |
| Hansen, 1994, Germany45 | CT | Papilledema, US ONSD | Relevant intracranial hypertension was confirmed when (a) obliteration of sulci with midline shift andor obliteration of the perimesencephalic cistern had been found on a CT scan and (b) an episode of rapid decline of conscious level not explained by drug application or epileptic seizures was or had been present. | Within 12 hours |
| Hansen, 1997, Germany46 | LP | Papilledema | >20 mmHg | NR |
| Hara, 1998, Japan47 | Epidural or IV | Midline Shift | Mean ICP values were divided into 4 groups: <20 mmHg (normal or slightly elevated), 21 to 40 mmHg (moderately elevated), over 40 mmHg (severely elevated but reduced to <41 mmHg with osmotherapy), and over 41 mmHg and uncontrollable with osmotherapy | Simultaneously |
| Haredy, 2018, USA48 | Papilledema, direct ICP monitoring, and/or LP | MRI ONSD, Papilledema | Papilledema, direct ICP monitoring, and/or lumbar puncture | Within 1 week |
| Hayashi, 1982, Japan49 | IV | Midline Shift, Papilledema | NR | Simultaneously |
| Helmke, 1996, Germany50 | CT and intracranial transducer | US ONSD | Clinical signs of raised ICP, narrowed ventricles on CT, aggressive therapy for raised ICP, invasive ICP monitor (>20 mmHg) | NR |
| Heuer, 2004, USA51 | IV | Motor Posturing | >20 mmHg | NR |
| Higgins, 2004, UK52 | A syndrome of raised intracranial pressure, usually manifest by headache and/or visual disturbance, without ventricular enlargement or an intracranial mass on imaging, with no evidence of venous sinus thrombosis, and with normal cerebrospinal fluid (CSF) constituents | SS | A syndrome of raised intracranial pressure, usually manifest by headache and/or visual disturbance, without ventricular enlargement or an intracranial mass on imaging, with no evidence of venous sinus thrombosis, and with normal cerebrospinal fluid (CSF) constituents | NR |
| Hoffmann, 2013, Germany53 | International Headache Society criteria | Empty sella, MRI ONSD, SF, SS | International Headache Society criteria | NR |
| Hukkelhoven, 2005, Netherlands54 | IP | Motor Posturing, PD | Repeatedly >20 mmHg | NR |
| Irazuzta, 2016, USA55 | LP | US ONSD | >20 cmH2O | Immediately before LP |
| Jeon, 2016, South Korea56 | Fiberoptic ICP probes | Midline Shift | >20 mmHg | Simultaneously |
| Jeon, 2017, South Korea57 | EVD | US ONSD | ICP over 20 mmHg | Simultaneously |
| Judy, 2018, USA58 | Intracranial fiberoptic probe | Papilledema | >15 mmHg | NR |
| Kamel, 2012, USA59 | IP | Midline Shift | >20 mmHg | NR |
| Kerscher, 2019, Germany60 | IP, closed EVD, puncture of the shunt reservoir, LP, IV, brain needle or epidural probe | US ONSD | ≥10 mmHg | Immediately before invasive method |
| Kienzler, 2018, Switzerland61 | IP or IV | TCD | >20 mmHg | Simultaneously |
| Kimberly, 2008, USA62 | EVD | US ONSD | >20 cmH2O | Simultaneously |
| Kishk, 2018, Egypt63 | LP | Papilledema, US ONSD | >250 mmH2O | NR |
| Kramer, 2016, Canada64 | Emergency DC | Compression or Absence of Basal Cisterns, Decreased Level of Consciousness, Marshall Score, Midline shift, PD | >20 mmHg | NR |
| Lashutka, 2004, USA65 | Ventriculostomy tubes or IP | IOP | >20 cmH2O | Simultaneously |
| Le, 2009, USA66 | CT or ventriculostomy or LP | US ONSD | At least 1 of the following criteria: (1) cranial CT findings suggestive of increased intracranial pressure (midline shift >3 mm, hydrocephalus, collapsed third ventricle, effacement of sulci with significant edema or abnormal mesencephalic cistern), or (2) an opening pressure of >20 cm of cerebrospinal fluid, as measured by ventriculostomy or lumbar puncture. | Within 3 hours |
| Lee, 2016, South Korea67 | CT or MRI | US ONSD | Significant brain edema, midline shift, compression of ventricle or basal cistern, effacement of sulci, insufficient gray/white differentiation, and transfalcine herniation | 1 hour |
| Lee, 2018, South Korea68 | Extracranial ventricular drainage or a ventriculoperitoneal shunt | CT ONSD PD | >20 mmHg | NR |
| Li, 2012, China69 | LP | IOP | >15 mmHg | <1 hour |
| Lim, 2010, UK70 | Modified Dandy criteria | Empty sella, MRI ONSD, ON protrusion, ON tortuosity, SF | Modified Dandy criteria | NR |
| Lim, 2017, Korea71 | TBI with midline shift | CT ONSD, Decreased Level of Consciousness | TBI with midline shift | Simultaneously |
| Lingawi, 2010, Saudi Arabia72 | Modified Dandy criteria | MRI and US ONSD | Modified Dandy criteria | NR |
| Liu, 2017, China73 | LP | MRI and US ONSD | >200 mmH2O | Within 10 minutes |
| Lochner, 2016, Germany74 | Friedmann 2013 | Internal jugular vein valve insufficiency, Papilledema, US ONSD | Friedmann 2013 | NR |
| Luyt, 2016, South Africa75 | LP | CT ONSD | >20 cmH2O | NR |
| Maissan, 2015, Netherlands76 | IP | US ONSD | >20 mmHg | Simultaneously |
| Major, 2011, UK77 | CT | US ONSD | Mass effect with midline shift of >3 mm, collapsed 3rd ventricle, hydrocephalus, effacement of sulci with evidence of substantial edema or abnormal mesencephalic cisterns | NR |
| Maralani, 2012, Canada78 | Modified Dandy Criteria | Empty sella, Inferior tonsillar displacement, MRI ONSD, ON enhancement, ON protrusion, ON tortuosity, Papilledema, Pituitary deformity, SF, SS, SLV, Tight subarachnoid spaces | Modified Dandy Criteria | NR |
| Marshall, 1983, USA79 | IV | Midline shift, PD | >20 mmHg | Simultaneously for oval pupil and NR for midline shift |
| Martin, 2019, France80 | IP | CT ONSD, PI, US ONSD | >20 mmHg | NR |
| Mehrpour, 2015, Iran81 | LP | US ONSD | >20 mmHg | NR |
| Melo, 2011, France82 | IP | TCD | >20 mmHg | NR |
| Miller, 1977, USA83 | A polyethylene cannula in the ventricle or by subarachnoid screw | Motor Posturing, PD | >15 mmHg | NR |
| Moretti, 2009, Italy (a)84 | IP or IV | US ONSD | >20 mmHg | Simultaneously |
| Moretti, 2009, Italy (b)85 | EVD or IP | US ONSD | >20 mmHg | <1 hour |
| Morris, 2017, USA86 | Revised modified Dandy criteria | Cephaloceles/Meningoceles, DWI bright spot at fundus, Empty sella, MRI ONSD, Papilledema, SS | Revised modified Dandy criteria | NR |
| Muchnok, 2012, USA87 | LP | IOP | >20 mmH2O | NR |
| Nabeta, 2014, Uganda88 | LP | IOP, US ONSD | >200 mmH2O | NR |
| Nagel, 2009, Germany89 | Ventricular drain and IP | Decreased Level of Consciousness | ≥20 mmHg | Simultaneously |
| Narayan, 1982, USA90 | Ventricular catheter, a subarachnoid screw (either alone, or plus a ventriculostomy) | Motor Posturing, PD | >20 mmHg | Simultaneously |
| Neudorfer, 201191 | LP | Papilledema | Opening CSF pressures of 20 cmH2O and 25 cmH2O were considered the upper normal limits for children and adults, respectively. | NR |
| Nirula, 2014, USA92 | Emergency DC | Compression or Absence of Basal Cisterns, Decreased Level of Consciousness, Midline Shift | NR | NR |
| O’Brien, 2015, USA93 | EVD or IP | PI, TCD | >20 mmHg | Within 24 hours |
| Pace, 2018, Canada94 | IP or IV | Decreased Level of Consciousness, Motor Posturing, PD | Head CT findings suggestive of raised ICP: midline shift, compression of the basal cisterns, and sulcal effacement or >20 mmHg within 1 hour of probe insertion | NR |
| Padayachy, 2016, South Africa95 | IP or IV | US ONSD | >20 mmHg | NR |
| Padayachy, 2018, South Africa96 | IP or IV | Deformability index, US ONSD | ≥20 mmHg | NR |
| Patterson, 2018, USA97 | Friedman 2013 | Empty sella, MRI ONSD, US ONSD | Friedman 2013 | Within 1 month |
| Pellerin, 2018, France98 | Revised modified Dandy criteria | Papilledema, SS | Revised modified Dandy criteria | NR |
| Prunet, 2012, France99 | IP | PI | >20 mmHg | Simultaneously |
| Qayyum, 2013, UK100 | CT | US ONSD | Midline shift with mass effect of at least 3 mm, effacement of sulci with evidence of substantial edema, collapse of ventricles, and cistern compression | NR |
| Rajajee, 2011, USA101 | EVD or IP | US ONSD | >20 mmHg | Simultaneously |
| Rajajee, 2018, USA102 | IP, IV, or CT | Compression or Absence of Basal Cisterns, Decreased Level of Consciousness | Compression or Absence of Basal Cisterns, Decreased Level of Consciousness, or >20 mmHg | Simultaneously |
| Ranganathan, 2013, USA103 | Modified Dandy criteria | Empty sella | Modified Dandy criteria | NR |
| Rasulo, 2017, Italy104 | IP or IV | TCD | >24.8 mmHg | simultaneously |
| Razek, 2018, Egypt105 | Friedman 2013 Criteria | Fractional anisotropy of ON, Mean diffusivity of ON | Friedman 2013 Criteria | NR |
| Ridha, 2013, USA106 | Modified Dandy Criteria or MRI and MRV findings | Empty sella, Increased perioptic CSF, ON tortuosity, Papilledema, SF, SS | Modified Dandy Criteria or the classic MRI and MRV findings for the cerebral venous thrombosis | NR |
| Robba, 2017, UK107 | IP or IV | Decreased Level of Consciousness, Marshall Score, Marshall Score, TCD, US ONSD | >20 mmHg | Simultaneously |
| Robba, 2019, UK108 | EVD, or bolt | US ONSD | ≥20 mmHg | Simultaneously |
| Sadhu, 1979, USA109 | a Richmond bolt, an in-dwelling ventriculostomy catheter | Midline Shift, Contralateral temporal horn dilatation, SLV, Tight subarachnoid spaces | >12 mmHg | NR |
| Saindane, 2013, USA110 | LP | Cephaloceles/Meningoceles, Increased Perioptic CSF, ON enhancement, ON protrusion, ON tortuosity, SF, SS | NR | NR |
| Saindane, 2018, USA111 | LP | Empty sella, Inferior tonsillar displacement, Meckel's caves abnormality, MRI ONSD, ON enhancement, ON protrusion, ON tortuosity, Papilledema, SF, SS | All patients had an elevated opening pressure of 36.0 cm water | Immediately before LP |
| Samuel, 1998, UK112 | Ventriculostomy | Papilledema, Tympanic membrane displacement | >20 mmHg | NR |
| Sekhon, 2014, UK113 | CT | CT ONSD | Presence of imaging features of increased ICP including midline shift >5 mm, herniation, compressed ventricles, basal cistern, and sulcal effacement or ICP of >20 mmHg | Simultaneously |
| Selhorst, 1985, USA114 | IP or IV | Decreased Level of Consciousness | NR | NR |
| Shirodkar, 2014, India115 | CT/MRI | US ONSD | Significant cerebral edema, midline shift, mass effect, effacement of sulci, collapse of ventricles, compression of cisterns and ONSD >5 mm on T2-MRI | NR |
| Širanović, 2011, Croatia116 | IV | US ONSD | >20 cmH2O | NR |
| Soldatos, 2008, Greece117 | IP | US ONSD | >20 mmHg | Simultaneously |
| Soliman, 2014, Saudi Arabia118 | LP | Empty sella, Increased OS-ON ratio, ON tortuosity, SF, SLV, US ONSD | ≥25 cmH2O | NR |
| Soliman, 2018, Saudi Arabia119 | IP | US ONSD | ≥20 mmHg | Simultaneously |
| Soustiel, 2010120 | IP or IV | Compression or Absence of Basal Cisterns, Midline Shift, PD | 20 mmHg | NR |
| Spentzas, 2010, USA121 | ICP transducer | IOP | 20 cmH2O | within 24 hrs and 48 hrs |
| Steinborn, 2016, Germany122 | IP or LP | Cystic subarachnoid space, Papilledema, US ONSD | Acute occlusive hydrocephalus, compressed or absent basal cisterns, Acute hypoxic ischemic encephalopathy, Midline shift >5 mm, Mass lesion >25 ml, or >15 mmHg using IP or LP | Within 2 hours |
| Swanson, 2017, USA123 | Flexible ICP monitor catheter | OCT, Papilledema | >15 mmHg | NR |
| Tabaddor, 1982, USA124 | IV | Midline Shift | NR | NR |
| Tayal, 2007, USA125 | CT | Decreased Level of Consciousness, US ONSD | Edema, midline shift, mass effect, effacement of sulci, collapse of ventricles, compression of cisterns | NR |
| Teasdale, 1984, Scotland126 | IV | Compression or Absence of Basal Cisterns | >20 mmHg | NR |
| Turkin, 2017, Russia127 | Intracranial monitor | CT ONSD | >20 mmHg | Within 48 hours |
| Vaiman, 2016128 | NR | CT ONSD | >20 mmHg | NR |
| Wakerley, 2015, MC129 | LP | PI | >20 cmH2O | 5 minutes |
| Wang, 2014, China130 | Intracranial monitor | PIRI | >15 mmHg | NR |
| Wang, 2015, China131 | LP | US ONSD | >20 cmH2O | <10 minutes |
| Wang, 2019, China132 | Microtransducer | US ONSD | >13 mmHg | Simultaneously |
| Wettervik, 2018, Sweden133 | Emergency DC | Marshall Score, PD | >20 mmHg | NR |
| Yuh, 2000, USA134 | LP | Empty sella, Pituitary deformity | NR | NR |
| Zoerle, 2015, Italy135 | IV | Decreased Level of Consciousness, Midline shift | >20 mmHg | NR |
| Zur, 2017136 | Modified Dandy Criteria | SS | Modified Dandy Criteria | NR |

*Abbreviations; NR=not reported, CT=computed tomography, US=ultrasound, ONSD=optic nerve sheath diameter, EVD=external ventricular drain, IP=intraparenchymal, IV=intraventricular, LP=lumbar puncture, DC=decompressive craniectomy, ICP=intracranial pressure, CSF=cerebrospinal fluid, MRI=magnetic resonance imaging, ON=optic nerve, OS=optic sheath, MC=multicenter, SLV=slit-like venrticles, PD=* *pupillary dilatation, SS=sinus stenosis, SF=scleral flattening.*

*\*Mean or median as reported by the paper.*

**Table S3. Risk of bias of the included studies.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Author, year, country | Risk of bias | | | Applicability concerns | | | | Overall |
| ***Patients' selection*** | ***Index test*** | ***Reference standard*** | ***Flow and timing*** | ***Patients' selection*** | ***Index test*** | ***Reference standard*** |
| Aduayi, 2015, Nigeria3 | Low | High | High | High | Low | High | High | High |
| Agid, 2006, Canada4 | Low | Low | Low | Low | Low | Low | Low | Low |
| Aiken, 2012, USA5 | High | High | Unclear | Low | Low | Low | Low | High |
| Albrecht, 2017, Germany6 | Low | Low | Low | Low | Low | Low | Low | Low |
| Alperin, 2000, USA7 | Unclear | Low | Low | High | Low | Low | Low | High |
| Amini, 2013, Iran (a)8 | Unclear | Unclear | Unclear | Unclear | High | Unclear | High | High |
| Amini, 2013, Iran (b)9 | Unclear | Unclear | Low | Low | Low | Low | High | High |
| Badri, 2012, USA10 | Low | Unclear | Low | Unclear | Low | Low | High | High |
| Bala, 2017, India11 | High | Unclear | High | High | High | Low | High | High |
| Bateman, 2002, Australia12 | Low | Unclear | High | High | Low | Low | Low | High |
| Bäuerle, 2011, Germany13 | Low | Unclear | High | High | Low | Unclear | Low | High |
| Beare, 2008, Malawi14 | Low | Unclear | High | High | Low | Unclear | Low | High |
| Bershad, 2016, USA15 | Low | Low | Low | Low | Low | Low | Low | Low |
| Bialer, 2014, USA16 | High | Unclear | Unclear | Low | Low | Unclear | Low | High |
| Bicakci, 2006, Turkey17 | Low | Low | Low | Low | Low | Low | Low | Low |
| Blaivas, 2003, USA18 | Low | Low | Low | Low | Low | Low | Low | Low |
| Blank, 1988, Germany19 | High | Low | Low | High | High | Unclear | High | High |
| Brodsky, 1998, USA20 | Unclear | Low | Unclear | Low | Low | Unclear | High | High |
| Burger, 2009, Germany21 | High | Low | High | High | High | Unclear | High | High |
| Butros, 2012, USA22 | High | Low | Unclear | Low | Low | Unclear | High | High |
| Caffery, 2014, USA23 | Unclear | Low | Low | High | Low | Unclear | Low | High |
| Cardim, 2019, UK24 | Low | Low | Unclear | Unclear | Unclear | Unclear | Low | High |
| Carvalho, 2017, Brazil25 | High | High | Unclear | Unclear | Unclear | High | High | High |
| Colquhoun, 1989, UK26 | High | Low | Unclear | Unclear | Unclear | Unclear | Low | High |
| Degnan, 2011, USA27 | High | High | Unclear | Unclear | Unclear | Low | Low | High |
| del Saz-Saucedo, 2016, Spain28 | High | Low | Low | High | High | Unclear | Low | High |
| Delen, 2018, Turkey29 | High | Low | Unclear | Low | Low | Unclear | Low | High |
| Donovan, 1998, USA30 | High | High | High | High | High | Unclear | Low | High |
| Ebraheim, 2018, Egypt31 | High | High | High | High | High | Unclear | High | High |
| Farb, 2003, Canada32 | Low | Low | Low | Low | Low | Low | Low | Low |
| Figaji, 2009, South Africa33 | Unclear | Unclear | Unclear | Unclear | Unclear | High | High | High |
| Firsching, 2011, Germany34 | Low | Low | Low | Low | Low | Low | Low | Low |
| Frumin, 2014, USA35 | Unclear | Unclear | Unclear | Unclear | High | High | High | High |
| Galbraith, 1981, Scotland36 | High | High | High | High | High | Low | High | High |
| Gass, 1996, UK37 | High | High | Unclear | Unclear | Low | Low | Low | High |
| Geeraerts, 2007, France38 | High | High | Unclear | Unclear | Unclear | Unclear | Low | High |
| Goel, 2008, India39 | Low | Low | Low | Low | Low | Low | Low | Low |
| Golan, 201340 | High | High | Unclear | Unclear | High | Unclear | Low | High |
| Görkem, 2015, Turkey41 | High | High | Unclear | Unclear | Low | Low | Low | High |
| Gupta, 2019, India42 | High | High | Unclear | Unclear | High | Low | Low | High |
| Hamani, 2003, Brazil43 | High | Unclear | Unclear | Unclear | Low | Low | Low | High |
| Hanafi, 2019, Iran44 | High | High | High | High | Low | High | Low | High |
| Hansen, 1994, Germany45 | Unclear | High | Low | Low | High | Low | Low | High |
| Hansen, 1997, Germany46 | High | Low | Low | High | Low | Low | Low | Low |
| Hara, 1998, Japan47 | Unclear | Unclear | Low | Low | High | Unclear | Low | High |
| Haredy, 2018, USA48 | Unclear | Unclear | Low | Low | High | High | High | High |
| Hayashi, 1982, Japan49 | High | High | High | Low | High | Low | Low | High |
| Helmke, 1996, Germany50 | High | Unclear | High | High | High | Unclear | High | High |
| Heuer, 2004, USA51 | Unclear | Unclear | Low | High | High | Unclear | High | High |
| Higgins, 2004, UK52 | High | High | Unclear | Low | Low | Low | Low | High |
| Hoffmann, 2013, Germany53 | High | High | Unclear | Low | Low | Low | Low | High |
| Hukkelhoven, 2005, Netherlands54 | High | Unclear | Unclear | High | Low | Unclear | High | High |
| Irazuzta, 2016, USA55 | Low | Low | Low | Low | Low | Low | Low | Low |
| Jeon, 2016, South Korea56 | High | Unclear | Low | Low | High | Unclear | High | High |
| Jeon, 2017, South Korea57 | Low | Unclear | Low | High | Low | Low | High | High |
| Judy, 2018, USA58 | High | Unclear | Unclear | Unclear | High | Unclear | High | High |
| Kamel, 2012, USA59 | High | Low | Low | High | High | Low | High | High |
| Kerscher, 2019, Germany60 | Low | Low | Low | Low | Low | Low | Low | Low |
| Kienzler, 2018, Switzerland61 | Low | Low | Low | Low | Low | Low | Low | Low |
| Kimberly, 2008, USA62 | Unclear | Unclear | Low | Low | Unclear | Low | Low | High |
| Kishk, 2018, Egypt63 | High | Unclear | Low | Unclear | High | Low | Low | High |
| Kramer, 2016, Canada64 | Low | Low | Low | Low | Low | Low | Low | Low |
| Lashutka, 2004, USA65 | Low | Low | Low | Low | Low | Low | Low | Low |
| Le, 2009, USA66 | Low | Low | Low | Low | Low | Low | Low | Low |
| Lee, 2016, South Korea67 | Low | Low | Low | Low | Low | Low | Low | Low |
| Lee, 2018, South Korea68 | High | Unclear | Low | High | High | Low | High | High |
| Li, 2012, China69 | Unclear | Unclear | Low | Low | Low | High | High | High |
| Lim, 2010, UK70 | Low | Low | Low | Low | Low | Low | Low | Low |
| Lim, 2017, Korea71 | Unclear | Unclear | Low | Low | High | Low | High | High |
| Lingawi, 2010, Saudi Arabia72 | Unclear | High | Unclear | Low | Low | Low | Low | High |
| Liu, 2017, China73 | Low | Low | Low | Low | Low | Low | Low | Low |
| Lochner, 2016, Germany74 | High | Unclear | High | Unclear | High | Low | Low | High |
| Luyt, 2016, South Africa75 | Unclear | Unclear | Low | High | High | High | Low | High |
| Maissan, 2015, Netherlands76 | Unclear | Unclear | Low | Low | Low | High | High | High |
| Major, 2011, UK77 | Low | Low | Low | Low | Low | Low | Low | Low |
| Maralani, 2012, Canada78 | Low | Low | Low | Low | Low | Low | Low | Low |
| Marshall, 1983, USA79 | High | Low | Low | Unclear | High | High | Low | High |
| Martin, 2019, France80 | High | Unclear | Low | Unclear | High | Low | Unclear | High |
| Mehrpour, 2015, Iran81 | Unclear | Low | Unclear | High | High | High | Unclear | High |
| Melo, 2011, France82 | High | Low | Unclear | High | Low | High | Unclear | High |
| Miller, 1977, USA83 | High | Unclear | Unclear | Unclear | High | Low | Unclear | High |
| Moretti, 2009, Italy (a)84 | Low | Low | Low | Low | Low | Low | Low | Low |
| Moretti, 2009, Italy (b)85 | Low | Low | Low | Low | Low | Low | Low | Low |
| Morris, 2017, USA86 | High | Unclear | Unclear | Low | Low | High | Unclear | High |
| Muchnok, 2012, USA87 | High | Unclear | Unclear | High | Low | Low | Unclear | High |
| Nabeta, 2014, Uganda88 | High | Unclear | Unclear | High | High | Low | Unclear | High |
| Nagel, 2009, Germany89 | Low | Low | Low | Low | Low | Low | Low | Low |
| Narayan, 1982, USA90 | High | Low | Unclear | Low | High | High | Unclear | High |
| Neudorfer, 201191 | High | Unclear | High | High | High | High | Low | High |
| Nirula, 2014, USA92 | Low | Low | Low | Low | Low | Low | Low | Low |
| O’Brien, 2015, USA93 | Low | Low | Low | Low | Low | Low | Low | Low |
| Pace, 2018, Canada94 | Low | Low | Low | Low | Low | Low | Low | Low |
| Padayachy, 2016, South Africa95 | Low | High | High | High | High | High | Unclear | High |
| Padayachy, 2018, South Africa96 | Low | Unclear | Low | High | Low | Unclear | Unclear | High |
| Patterson, 2018, USA97 | Low | Low | Low | Low | Low | Low | Low | Low |
| Pellerin, 2018, France98 | Unclear | High | Unclear | Low | Low | Unclear | Unclear | High |
| Prunet, 2012, France99 | High | Unclear | High | High | Unclear | Unclear | High | High |
| Qayyum, 2013, UK100 | Low | Low | Low | Low | Low | Low | Low | Low |
| Rajajee, 2011, USA101 | Low | Low | Low | Low | Low | Low | Low | Low |
| Rajajee, 2018, USA102 | High | Unclear | Low | Low | Unclear | Unclear | Low | High |
| Ranganathan, 2013, USA103 | High | High | Unclear | Low | Unclear | Low | Low | High |
| Rasulo, 2017, Italy104 | Low | Unclear | Low | Unclear | Unclear | High | High | High |
| Razek, 2018, Egypt105 | Low | Low | Low | Low | Low | Low | Low | Low |
| Ridha, 2013, USA106 | Low | Low | Low | Low | Low | Low | Low | Low |
| Robba, 2017, UK107 | Low | Low | Low | Low | Low | Low | Low | Low |
| Robba, 2019, UK108 | Low | Low | Low | Low | Low | Low | Low | Low |
| Sadhu, 1979, USA109 | High | High | High | High | High | Low | Low | High |
| Saindane, 2013, USA110 | Low | Low | Low | Low | Low | Low | Low | Low |
| Saindane, 2018, USA111 | Low | Unclear | Low | Unclear | Unclear | Low | Low | High |
| Samuel, 1998, UK112 | High | Unclear | Low | Unclear | Unclear | High | High | High |
| Sekhon, 2014, UK113 | Low | Low | Low | Low | Low | Low | Low | Low |
| Selhorst, 1985, USA114 | High | Low | High | High | High | Low | Low | High |
| Shirodkar, 2014, India115 | Low | High | Unclear | Unclear | Low | Low | Low | High |
| Širanović, 2011, Croatia116 | Low | Low | Low | Low | Low | Low | Low | Low |
| Soldatos, 2008, Greece117 | Low | Low | Unclear | Unclear | Low | Low | Low | High |
| Soliman, 2014, Saudi Arabia118 | Low | Low | Unclear | Unclear | Low | Low | Low | High |
| Soliman, 2018, Saudi Arabia119 | Low | Low | Low | Low | Low | Low | Low | Low |
| Soustiel, 2010120 | Low | Low | Low | Low | Low | Low | Low | Low |
| Spentzas, 2010, USA121 | Low | Low | Low | Low | Low | Low | Low | Low |
| Steinborn, 2016, Germany122 | High | High | Unclear | High | Low | Low | Low | High |
| Swanson, 2017, USA123 | Low | Low | Low | Low | Low | Low | Low | Low |
| Tabaddor, 1982, USA124 | High | High | High | High | High | Low | Low | High |
| Tayal, 2007, USA125 | Unclear | High | Unclear | High | High | Low | Low | High |
| Teasdale, 1984, Scotland126 | Unclear | High | Low | Unclear | Unclear | Unclear | High | High |
| Turkin, 2017, Russia127 | Low | Low | Low | Low | Low | Low | Low | Low |
| Vaiman, 2016128 | Low | Low | Low | Low | Low | Low | Low | Low |
| Wakerley, 2015, MC129 | Unclear | High | Low | Unclear | Unclear | Unclear | Low | High |
| Wang, 2014, China130 | Unclear | Unclear | Low | Unclear | Unclear | Unclear | Low | High |
| Wang, 2015, China131 | Low | Low | Low | Low | Low | Low | Low | Low |
| Wang, 2019, China132 | Unclear | Unclear | Low | Unclear | Unclear | Unclear | Low | High |
| Wettervik, 2018, Sweden133 | Low | Low | Low | Low | Low | Low | Low | Low |
| Yuh, 2000, USA134 | Unclear | High | Unclear | Low | Low | Low | Low | High |
| Zoerle, 2015, Italy135 | Low | Low | Low | Low | Low | Low | Low | Low |
| Zur, 2017136 | High | High | Unclear | Low | Low | Low | Low | High |

*Abbreviations; MC=multicenter.*

*\*According to the QUADAS-2 tool recommendations, if a study is judged as “low” on all domains relating to bias or applicability, then it is appropriate to have an overall judgment of “low risk of bias” or “low concern regarding applicability” for that study while If a study is judged “high” or “unclear” in one or more domains, then it may be judged “at risk of bias” or as having “concerns regarding applicability”137.*

**Table S4. The performance and definition of other methods not included in the analysis.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Author, year, country | *Test* | *Cut-off/definition* | *TP* | *FP* | *FN* | *TN* | *Prevalence* |
| Alperin, 2000, USA7 | MR-derived ICP | >15 mmHg | 5 | 0 | 1 | 25 | 0.19 |
| Butros, 2012, USA22 | Widening of FO | 29.9 mm2 | 24 | 8 | 24 | 36 | 0.52 |
| Cardim, 2019, UK24 | JVP | 12.65 mmHg | 12 | 9 | 2 | 55 | 0.18 |
| Firsching, 2011, Germany34 | Venous ophthalmodynamometry | >30 mmHg (the pressure within the central retinal vein) | 16 | 3 | 6 | 77 | 0.22 |
| Lochner, 2016, Germany74 | Internal jugular vein valve insufficiency | - | 11 | 9 | 10 | 12 | 0.50 |
| Morris, 2017, USA86 | DWI bright spot at fundus | DWI bright spot at optic fundus | 6 | 1 | 57 | 95 | 0.40 |
| Padayachy, 2018, South Africa96 | DI | DI ≤0.185 | 17 | 1 | 2 | 8 | 0.68 |
| Razek, 2018, Egypt105 | Fractional anisotropy of ON | 0.28 | 30 | 11 | 1 | 6 | 0.65 |
| Razek, 2018, Egypt105 | Mean diffusivity of ON | 1.22×10-3 mm2/s | 30 | 7 | 1 | 10 | 0.65 |
| Ridha, 2013, USA106 | Increased perioptic CSF | - | 23 | - | 37 | - | - |
| Sadhu, 1979, USA | Contralateral temporal horn dilatation | - | 6 | 1 | 11 | 15 | 0.52 |
| Saindane, 2013, USA110 | Increased Perioptic CSF | - | 41 | - | 5 | - | - |
| Samuel, 1998, UK112 | Tympanic membrane displacement | The ICP was then indirectly quantified in terms of the mean TMD (Vm) measured from the time of maximum inward displacement achieved while the acoustic stimulus is present, to the time of stimulus switch off. The mean volume displacement of the TM is a more reliable and reproducible value, hence used in the measurement of the TMD test. The objective measure of lCP by TMD test with Vm value of -200 nl and mare negative should be indicative of raised CSF pressure and a Vm value of +200 nl and greater, for low lCP. A dear dissociation between normal, raised and low lCP was present with a sensitivity of 82% and specificity of 100% for a normal-raised TMD limit set to -200 nl. | 22 | 0 | 5 | 41 | 0.40 |
| Soliman, 2014, Saudi Arabia118 | Increased OS-ON ratio | >2.5 | 16 | 2 | 4 | 18 | 0.50 |
| Steinborn, 2016, Germany | Cystic subarachnoid space | Subarachnoid space of the retrobulbar optic nerve (grade 2 or 3) | 20 | 7 | 5 | 49 | 0.31 |
| Swanson, 2017, USA123 | OCT | Test positive is defined as any OCT parameter (maximal RNFL thickness, Maximal retinal thickness, and maximal anterior retinal projection) is above their cutpoint in either eye | 17 | 8 | 2 | 13 | 0.48 |
| Wang, 2014, China130 | RI | 0.705 | 19 | 2 | 2 | 70 | 0.23 |

*Abbreviations; NR=not reported, CT=computed tomography, US=ultrasound, ONSD=optic nerve sheath diameter, MRI=magnetic resonance imaging, ON=optic nerve, OS=optic sheath, MC=multicenter, DWI=diffusion-weighted magnetic resonance imaging, deformability index=DI, JVP=jugular venous pressure.*

**The** **search term;**

("lumbar puncture" OR "external ventricular" OR “extraventricular” OR ventriculostomy OR intraparenchymal OR epidural OR intraventricular OR subdural OR microtransducer OR intraocular OR “resonance” OR “optic nerve” OR ultrasonography OR ultrasound OR ultrasonographic OR transcranial OR doppler OR CT OR fundoscopy OR tomography OR spectroscopy OR velocity OR ophthalmic OR dynamometry OR ophthalmodynamometry OR jugular OR potential OR pupillometry OR otic OR otoacoustic OR acoustic OR electroencephalography OR vibration OR tympanic OR pulsation) **AND** (invasive OR noninvasive) **AND** (“intracranial pressure” OR “intracranial hypertension” OR “intracranial tension” OR ICP) **AND** (sensitivity OR specificity OR AUC OR accuracy OR ROC OR “area under the curve” OR “receiver operating characteristic”)

* **Searching databases**

**Date of search; 28/August/2019**

**1. PubMed**Search: 425 results  
("lumbar puncture" OR "external ventricular" OR “extraventricular” OR ventriculostomy OR intraparenchymal OR epidural OR intraventricular OR subdural OR microtransducer OR intraocular OR “resonance” OR “optic nerve” OR ultrasonography OR ultrasound OR ultrasonographic OR transcranial OR doppler OR CT OR fundoscopy OR tomography OR spectroscopy OR velocity OR ophthalmic OR dynamometry OR ophthalmodynamometry OR jugular OR potential OR pupillometry OR otic OR otoacoustic OR acoustic OR electroencephalography OR vibration OR tympanic OR pulsation) **AND** (invasive OR noninvasive) **AND** (“intracranial pressure” OR “intracranial hypertension” OR “intracranial tension” OR ICP) **AND** (sensitivity OR specificity OR AUC OR accuracy OR ROC OR “area under the curve” OR “receiver operating characteristic”)

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**2. ISI (core collection):**210 results, (filter: reviews excluded)  
TOPIC: (("lumbar puncture" OR "external ventricular" OR “extraventricular” OR ventriculostomy OR intraparenchymal OR epidural OR intraventricular OR subdural OR microtransducer OR intraocular OR “resonance” OR “optic nerve” OR ultrasonography OR ultrasound OR ultrasonographic OR transcranial OR doppler OR CT OR fundoscopy OR tomography OR spectroscopy OR velocity OR ophthalmic OR dynamometry OR ophthalmodynamometry OR jugular OR potential OR pupillometry OR otic OR otoacoustic OR acoustic OR electroencephalography OR vibration OR tympanic OR pulsation) AND (invasive OR noninvasive) AND (“intracranial pressure” OR “intracranial hypertension” OR “intracranial tension” OR ICP) AND (sensitivity OR specificity OR AUC OR accuracy OR ROC OR “area under the curve” OR “receiver operating characteristic”))

<http://0810os5cq.1103.y.http.apps.webofknowledge.com.mplbci.ekb.eg/Search.do?product=WOS&SID=F55fAHGakkJGePmvEET&search_mode=GeneralSearch&prID=d8129a45-d0ae-4cd0-a472-3e91c9b9a6cc>

\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3. Cochrane**25 results in title/abstract/keywords  
("lumbar puncture" OR "external ventricular" OR “extraventricular” OR ventriculostomy OR intraparenchymal OR epidural OR intraventricular OR subdural OR microtransducer OR intraocular OR “resonance” OR “optic nerve” OR ultrasonography OR ultrasound OR ultrasonographic OR transcranial OR doppler OR CT OR fundoscopy OR tomography OR spectroscopy OR velocity OR ophthalmic OR dynamometry OR ophthalmodynamometry OR jugular OR potential OR pupillometry OR otic OR otoacoustic OR acoustic OR electroencephalography OR vibration OR tympanic OR pulsation) **AND** (invasive OR noninvasive) **AND** (“intracranial pressure” OR “intracranial hypertension” OR “intracranial tension” OR ICP) **AND** (sensitivity OR specificity OR AUC OR accuracy OR ROC OR “area under the curve” OR “receiver operating characteristic”)

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**4. Scopus:**320 results, (filter: reviews and book chapters excluded, total =386)  
( TITLE-ABS-KEY ( "lumbar puncture" OR "external ventricular" OR "extraventricular" OR ventriculostomy OR intraparenchymal OR epidural OR intraventricular OR subdural OR microtransducer OR intraocular OR "resonance" OR "optic nerve" OR ultrasonography OR ultrasound ) OR TITLE-ABS-KEY ( ultrasonographic OR transcranial OR doppler OR ct OR fundoscopy OR tomography OR spectroscopy OR velocity OR ophthalmic OR dynamometry OR ophthalmodynamometry OR jugular OR potential OR pupillometry OR otic OR otoacoustic OR acoustic ) OR TITLE-ABS-KEY ( electroencephalography OR vibration OR tympanic OR pulsation ) AND TITLE-ABS-KEY ( invasive OR noninvasive ) AND TITLE-ABS-KEY ( "intracranial pressure" OR "intracranial hypertension" OR "intracranial tension" OR icp ) AND TITLE-ABS-KEY ( sensitivity OR specificity OR auc OR accuracy OR roc OR "area under the curve" OR "receiver operating characteristic" ) )

( TITLE-ABS-KEY ( "lumbar puncture" OR "external ventricular" OR "extraventricular" OR ventriculostomy OR intraparenchymal OR epidural OR intraventricular OR subdural OR microtransducer OR intraocular OR "resonance" OR "optic nerve" OR ultrasonography OR ultrasound ) OR TITLE-ABS-KEY ( ultrasonographic OR transcranial OR doppler OR ct OR fundoscopy OR tomography OR spectroscopy OR velocity OR ophthalmic OR dynamometry OR ophthalmodynamometry OR jugular OR potential OR pupillometry OR otic OR otoacoustic OR acoustic ) OR TITLE-ABS-KEY ( electroencephalography OR vibration OR tympanic OR pulsation ) AND TITLE-ABS-KEY ( invasive OR noninvasive ) AND TITLE-ABS-KEY ( "intracranial pressure" OR "intracranial hypertension" OR "intracranial tension" OR icp ) AND TITLE-ABS-KEY ( sensitivity OR specificity OR auc OR accuracy OR roc OR "area under the curve" OR "receiver operating characteristic" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) OR LIMIT-TO ( DOCTYPE , "cp" ) OR LIMIT-TO ( DOCTYPE , "ed" ) OR LIMIT-TO ( DOCTYPE , "le" ) OR LIMIT-TO ( DOCTYPE , "no" ) OR LIMIT-TO ( DOCTYPE , "sh" ) OR LIMIT-TO ( DOCTYPE , "Undefined" ) )

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**5. Embase**

467results((lumbar puncture) OR (external ventricular) OR (extraventricular) OR ventriculostomy OR intraparenchymal OR epidural OR intraventricular OR subdural OR microtransducer OR intraocular OR (resonance) OR (optic nerve) OR ultrasonography OR ultrasound OR ultrasonographic OR transcranial OR doppler OR CT OR fundoscopy OR tomography OR spectroscopy OR velocity OR ophthalmic OR dynamometry OR ophthalmodynamometry OR jugular OR potential OR pupillometry OR otic OR otoacoustic OR acoustic OR electroencephalography OR vibration OR tympanic OR pulsation) **AND** (invasive OR noninvasive) **AND** ((intracranial pressure) OR (intracranial hypertension) OR (intracranial tension) OR ICP) **AND** (sensitivity OR specificity OR AUC OR accuracy OR ROC OR (area under the curve) OR (receiver operating characteristic))

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
Total from ALL databases = 1,447  
Duplicates = 565  
Without duplicates = 882

***Other Individual Studies***

Other methods, that were not reported enough to be analyzed, included contralateral temporal horn dilatation, cystic subarachnoid space, deformability index (DI), diffusion-weighted magnetic resonance imaging bright spot at the fundus, fractional anisotropy (FA) as well as mean diffusivity of ON, increased ONS-ON ratio, increased perioptic cerebrospinal fluid (CSF), internal jugular vein valve insufficiency, jugular venous pressure, MRI-derived ICP, optical coherence tomography (OCT), resistance index (RI), tympanic membrane displacement (TMD), venous ophthalmodynamometry, and widening of foramen ovale with the DI, increased ONS-ON ratio, FA as well as mean diffusivity of ON, MRI-derived ICP, OCT, RI, and TMD having high sensitivity and/or specificity (Supplemental File 2-Table S4).

**F:\Medical\FL\Mohamed\6. Dr Ahmed\6. ICP. SR\5. Manuscript\ICP. Figures\S1.tif**

**Figure S1. Summary of QUADAS-2 assessments of the 134 included studies.**

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**Supplemental Digital Content 3: The summary estimates of the non-invasive diagnostic tests for the diagnosis of elevated intracranial pressure**\***.**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test | Studies/individuals number | Sensitivity, 95% CI | Specificity, 95% CI | DOR, 95% CI | LR, 95% CI | | AUC, 95% CI | Heterogeneity# | | P-value\*\* |
| **Positive** | **Negative** | **I2** | **P-value** |
| ONSD | | | | | | | | | | |
| *US ONSD* | 50/4,199 | 90 [87, 92] | 88 [84, 91] | 63 [43, 94] | 7.4 [5.5, 9.8] | 0.12 [0.09, 0.15] | 0.95 [0.92, 0.96] | 97 | <0.001 | 0.88 |
| *CT ONSD* | 7/656 | 93 [90, 96] | 79 [56, 92] | 53 [18, 156] | 4.4 [ 1.9, 10.2] | 0.08 [0.05, 0.13] | 0.94 [0.92, 0.96] | 70 | 0.017 | - |
| *MRI ONSD* | 15/1,013 | 77 [64, 87] | 89 [84, 93] | 29 [13, 64] | 7.2 [ 4.6, 11.3] | 0.25 [0.15, 0.43] | 0.92 [0.89, 0.94] | 93 | <0.001 | 0.228 |
| IOP | 7/634 | 75 [24, 97] | 82 [55, 94] | 14 [1, 174] | 4.2 [1.3, 13.2] | 0.3 [0.05, 1.67] | 0.86 [0.83, 0.89] | 97 | <0.001 | - |
| PI | 6/559 | 84 [55, 96] | 94 [89, 97] | 81 [13, 496] | 13.8 [ 6.5, 29.1] | 0.17 [0.05, 0.58] | 0.96 [0.93, 0.97] | 81 | 0.002 | - |
| TCD | 7/825 | 87 [80, 92] | 70 [40, 89] | 16 [ 3, 81] | 2.9 [ 1.2, 7.1] | 0.18 [0.08, 0.39] | 0.89 [0.86, 0.91] | 75 | 0.009 | - |
| Papilloedema | 24/1,284 | 70 [46, 87] | 95 [92, 97] | 48 [16, 142] | 15.0 [8.3, 27.1] | 0.31 [0.16, 0.64] | 0.96 [0.94, 0.97] | 98 | <0.001 | 0.862 |
| CT signs | | | | | | | | | | |
| *Compression or Absence of Basal Cisterns* | 6/670 | 96 [55, 100] | 59 [32, 82] | 33 [1, 790] | 2.4 [1.2, 4.7] | 0.07 [0, 1.24] | 0.82 [0.78, 0.85] | 91 | <0.001 | - |
| *Midline shift* | | | | | | | | | | |
| *Any midline shift* | 8/627 | 79 [71, 86] | 46 [21, 74] | 3 [1, 8] | 1.5 [0.9, 2.4] | 0.45 [0.28, 0.72] | 0.77 [0.73, 0.8] | 96 | <0.001 | - |
| *≥5 mm* | 10/883 | 53 [39, 66] | 68 [49, 83] | 2 [1, 5] | 1.6 [1.0, 2.6] | 0.69 [0.54, 0.9] | 0.62 [0.58, 0.66] | 94 | <0.001 | 0.164 |
| *≥10 mm* | 8/651 | 21 [15, 28] | 91 [75, 97] | 3 [1, 8] | 2.2 [0.8, 6.3] | 0.87 [0.78, 0.98] | 0.32 [0.28, 0.36] | 2 | 0.18 | - |
| *Marshall score* | | | | | | | | | | |
| *≥3* | 4/1,316 | 80 [71, 87] | 62 [34, 84] | 7 [2, 19] | 2.1 [1.1, 4.1] | 0.32 [0.2, 0.51] | 0.81 [0.78, 0.84] | 57 | 0.048 | - |
| *≥4* | 4/1,316 | 56 [39, 71] | 71 [66, 75] | 3 [1, 7] | 1.9 [1.3, 2.9] | 0.62 [0.41, 0.95] | 0.71 [0.67, 0.75] | 53 | 0.058 | - |
| *≥5* | 4/1,316 | 45 [3, 62] | 85 [67, 94] | 5 [2, 14] | 3 [1.3, 6.9] | 0.65 [0.47, 0.89] | 0.69 [0.65, 0.73] | 19 | 0.146 | - |
| Physical examination signs | | | | | | | | | | |
| *Pupillary dilatation* | 11/2147 | 28 [17, 43] | 86 [76, 93] | 2 [2, 4] | 2.1 [1.5, 2.9] | 0.83 [0.74, 0.93] | 0.63 [0.59, 0.67] | 99 | <0.001 | 0.697 |
| *Decreased level of consciousness (GCS ≤8)* | 13/2,580 | 73 [59, 84] | 42 [26, 60] | 2 [1, 3] | 1.3 [1, 1.5] | 0.64 [0.49, 0.84] | 0.63 [0.58, 0.67] | 99 | <0.001 | 0.276 |
| *Motor posturing (GCS ≤3)* | 6/830 | 55 [37, 74] | 63 [43, 78] | 2.01 [1.4, 2.9] | 2.29 [0.95, 4.77] | 1.53 [0.97, 2.32] | 0.617 | 99 | <0.001 | - |
| MRI signs | | | | | | | | | | |
| *Tight subarachnoid spaces* | 4/252 | 9 [2, 33] | 95 [83, 99] | 2 [1, 7] | 2.1 [ 0.7, 6.3] | 0.95 [0.85, 1.06] | 0.71 [0.67, 0.75] | 91 | <0.001 | - |
| *Slit-like ventricles* | 5/292 | 25 [6, 65] | 98 [53, 100] | 20 [1, 610] | 14.9 [0.5, 463.2] | 0.76 [0.51, 1.13] | 0.76 [0.72, 0.8] | 95 | <0.001 | - |
| *Sinus stenosis* | 13/862 | 90 [75, 96] | 96 [91, 99] | 226 [50, 1,03] | 24.2 [9.1, 64.2] | 0.11 [0.04, 0.28] | 0.98 [0.97, 0.99] | 89 | <0.001 | 0.487 |
| *Pituitary deformity* | 2/186 | 42 [33, 51] | 93 [83, 98] | 226 [50, 1,033] | 8.21 [2.92, 23.08] | 0.62 [0.53, 0.73] | - | 0 | 0.394 | - |
| *ON tortuosity* | 11/613 | 46 [37, 56] | 91 [87, 94] | 9 [5, 15] | 5 [3.3, 7.6] | 0.59 [0.49, 0.7] | 0.9 [0.87, 0.92] | 42 | 0.09 | 0.024 |
| *ON enhancement* | 5/259 | 30 [04, 82] | 99 [88, 100] | 60 [1, 3,050] | 42.6 [1.3, 1381.9] | 0.71 [0.35, 1.43] | 0.99 [0.98, 1] | 0 | 0.323 | - |
| *Meckel's caves abnormality* | 3/265 | 39 [30, 47] | 93 [88, 97] | 93 [88, 97] | 5.62 [3.01, 10.48] | 0.32 [0.03, 3.02] | - | 0 | 0.419 | - |
| *ON protrusion* | 8/421 | 36 [17, 61] | 99 [96, 100] | 102 [12, 886] | 65.1 [8.4, 503.9] | 0.64 [0.45, 0.92] | 0.99 [0.98, 1] | 0 | 0.219 | - |
| *Posterior globe flattening* | 12/663 | 61 [50, 71] | 99 [91, 100] | 126 [16, 978] | 49.6 [6.5, 377.4] | 0.39 [0.30, 0.51] | 0.85 [0.81, 0.88] | 91 | <0.001 | 0.733 |
| *Inferior position of cerebellar tonsils* | 4/239 | 28 [7, 68] | 95 [88, 98] | 7 [1, 36] | 5.3 [1.6, 18] | 0.76 [0.47, 1.20] | 0.93 [0.91, 0.95] | 65 | 0.029 | - |
| *Empty sella* | 17/1,058 | 65 [50, 78] | 94 [88, 97] | 29 [13, 65] | 10.6 [5.6, 20.1] | 0.37 [0.24, 0.56] | 0.92 [0.89, 0.94] | 95 | <0.001 | 0.889 |
| *Cephaloceles/Meningoceles* | 2/316 | 29 [22, 37] | 99 [96, 99] | 31.55 [3.21, 309.9] | 21.25 [3.73, 121.03] | 0.67 [0.29, 1.58] | - | 59.3 | 0.117 | - |

*Abbreviations; CI=confidence interval, DOR=diagnostic odds ratio, LR=likelihood ratio, ONSD=ultrasound optic nerve sheath distension, US=ultrasound, MRI=magnetic resonance imaging, GCS=Glasgow Coma Scale, CT=computed tomography, ON=optic nerve, TCD=transcranial doppler, PI=pulsatility index, IOP=intraocular pressure.*

*#P-value of the publication bias.*

**Supplemental Digital Content 4: Meta-regression: estimated influence of study characteristics on the diagnostic accuracy measures**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Method | | | | US ONSD | | MRI ONSD | Pupillary dilation | Papilloedema | Midline shift (5 mm) | Decreased level of consciousness (GCS) | Sinus stenosis | ON tortuosity | Flattening | Empty sella |
|
| Pathology (TBI vs others) | **TBI** | ***Sensitivity*** | **90 [86, 94]** | | - | | 30 [15, 45] | - | 53 [33, 73] | 78 [62, 94] | - | 40 [8, 72] | - | 81 [43, 100] |
| ***Specificity*** | **85 [77, 94]** | | - | | 86 [76, 95] | - | 61 [36, 85] | 30 [16, 44] | - | 95 [85, 100] | - | 91 [71, 100] |
| **Others** | ***Sensitivity*** | 90 [87, 92] | | - | | 24 [0, 48] | - | 54 [32, 77] | 72 [48, 95] | - | 47 [37, 57] | - | 65 [51, 79] |
| ***Specificity*** | 88 [85, 92] | | - | | 87 [70, 100] | - | 75 [54, 96] | 62 [43, 81] | - | 90 [87, 94] | - | 94 [90, 98] |
| Pathology (IIH vs others) | **IIH** | ***Sensitivity*** | **86 [77, 95]** | | 81 [67, 95] | | - | 78 [53, 100] | - | - | 90 [80, 100] | **50 [37, 62]** | 63 [50, 77] | 63 [46, 81] |
| ***Specificity*** | 91 [82, 100] | | **90 [85, 96]** | | - | 97 [95, 99] | - | - | 96 [93, 99] | 90 [86, 95] | 97 [91, 100] | 95 [90, 99] |
| **Others** | ***Sensitivity*** | 90 [88, 92] | | 72 [52, 92] | | - | 61 [29, 94] | - | - | 86 [61, 100] | 42 [29, 56] | 58 [42, 74] | 71 [51, 91] |
| ***Specificity*** | 87 [84, 91] | | 88 [81, 95] | | - | 90 [83, 97] | - | - | 79 [58, 100] | 91 [85, 97] | 100 [99, 100] | 91 [82, 100] |
| Prevalence | | ***Sensitivity*** | 87 [67, 95] | | 99 [23, 100] | | 46 [6, 92] | 100 [48, 100] | 18 [2, 71] | 80 [14, 99] | 98 [0, 100] | 7 [0, 99] | 98 [7, 100] | 98 [17, 100] |
| ***Specificity*** | 68 [29, 92] | | 91 [20, 100] | | 38 [4, 89] | 100 [89, 100] | 99 [52, 100] | 21 [01, 91] | 90 [0, 100] | 98 [13, 100] | 0 [0, 100] | 100 [94, 100] |
| Percent of female | | ***Sensitivity*** | 78 [55, 91] | | 46 [01, 99] | | 0 [0, 99] | - | 8 [1, 53] | 90 [22, 100] | 12 [0, 100] | - | - | - |
| ***Specificity*** | 79 [46, 95] | | 99 [74, 100] | | 98 [0, 100] | - | 99 [27, 100] | 63 [4, 99] | 60 [0, 100] | - | - | - |
| Age | **Adults** | ***Sensitivity*** | **90 [87, 92]** | | 80 [67, 93] | | - | 77 [58, 97] | - | - | - | 47 [35, 58] | **59 [47, 71]** | 69 [55, 83] |
| ***Specificity*** | 89 [85, 92] | | 91 [86, 95] | | - | 95 [92, 98] | - | - | - | 91 [87, 95] | 99 [98, 100] | 94 [89, 99] |
| **Children** | ***Sensitivity*** | 91 [85, 96] | | 77 [51, 100] | | - | 43 [4, 89] | - | - | - | 49 [25, 74] | 59 [33, 84] | 44 [02, 87] |
| ***Specificity*** | 81 [69, 92] | | 82 [69, 94] | | - | 95 [89, 100] | - | - | - | 88 [79, 97] | 92 [70, 100] | 94 [83, 100] |
| Timing | **Within one hour** | ***Sensitivity*** | 92 [89, 95] | | **100 [100, 100]** | | - | **94 [83, 100]** | - | - | - | - | - | - |
| ***Specificity*** | 90 [86, 93] | | **100 [100, 100]** | | - | 91 [81, 100] | - | - | - | - | - | - |
| **>1 hour** | ***Sensitivity*** | 86 [77, 96] | | 74 [61, 88] | | - | 65 [26, 100] | - | - | - | - | - | - |
| ***Specificity*** | 76 [61, 91] | | 88 [82, 94] | | - | 96 [82, 100] | - | - | - | - | - | - |
| Cut-off of ONSD | **<5.5 mm** | ***Sensitivity*** | **90 [87, 93]** | | 76 [59, 93] | | - | - | - | - | - | - | - | - |
| ***Specificity*** | **87 [82, 92]** | | **87 [80, 95]** | | - | - | - | - | - | - | - | - |
| **≥5.5 mm** | ***Sensitivity*** | 89 [86, 93] | | 78 [62, 93] | | - | - | - | - | - | - | - | - |
| ***Specificity*** | 88 [83, 93] | | 89 [84, 95] | | - | - | - | - | - | - | - | - |
| Risk of bias | **High** | ***Sensitivity*** | **90 [87, 93]** | | 79 [66, 92] | | - | **54 [29, 78]** | 55 [37, 74] | 70 [51, 89] | 82 [65, 99] | 49 [37, 61] | 62 [48, 75] | 73 [56, 90] |
| ***Specificity*** | **89 [85, 93]** | | 91 [87, 95] | | - | 95 [92, 98] | 72 [55, 89] | 43 [17, 70] | 96 [91, 100] | **43 [29, 56]** | **99 [96, 100]** | 94 [89, 99] |
| **Low** | ***Sensitivity*** | 90 [87, 93] | | 73 [51, 94] | | - | 96 [88, 100] | 53 [27, 79] | 76 [60, 92] | 96 [90, 100] | 91 [86, 96] | 60 [44, 77] | 60 [40, 79] |
| ***Specificity*** | 86 [79, 92] | | 83 [73, 92] | | - | 96 [92, 100] | 50 [20, 80] | 39 [15, 63] | 97 [93, 100] | 90 [85, 96] | 99 [94, 100] | 93 [86, 99] |
| Prospective design | **Yes** | ***Sensitivity*** | **90 [87, 92]** | | 88 [78, 99] | | 26 [12, 41] | **79 [58, 100]** | 61 [47, 75] | 74 [59, 89] | 77 [51, 100] | 49 [28, 71] | **54 [35, 74]** | 75 [56, 94] |
| ***Specificity*** | **87 [84, 91]** | | 95 [90, 99] | | 87 [78, 96] | 93 [89, 97] | 69 [42, 95] | 44 [21, 68] | 98 [95, 100] | 96 [90, 100] | 100 [98, 100] | 92 [84, 100] |
| **No** | ***Sensitivity*** | 91 [84, 97] | | 68 [53, 82] | | 35 [08, 62] | 55 [18, 92] | 43 [31, 56] | 72 [53, 91] | 94 [86, 100] | 46 [35, 57] | 64 [52, 75] | 61 [43, 78] |
| ***Specificity*** | 91 [83, 100] | | 87 [81, 93] | | 85 [70, 100] | 97 [95, 100] | 68 [45, 90] | 39 [12, 65] | 95 [90, 100] | 90 [86, 94] | 98 [94, 100] | 95 [90, 99] |
| ICP cut-off | **≥20 mmHg** | ***Sensitivity*** | **91 [88, 95]** | | - | | - | - | - | 78 [66, 90] | - | **100 [100, 100]** | - | - |
| ***Specificity*** | **88 [83, 94]** | | - | | - | - | - | 37 [17, 57] | - | **100 [100, 100]** | - | - |
| **<20 mmHg** | ***Sensitivity*** | 89 [86, 92] | | - | | - | - | - | 60 [36, 83] | - | 44 [36, 51] | - | - |
| ***Specificity*** | 88 [83, 92] | | - | | - | - | - | 49 [16, 81] | - | 91 [87, 94] | - | - |

*Abbreviations; ONSD=ultrasound optic nerve sheath distension, US=ultrasound, MRI=magnetic resonance imaging, ON=optic nerve, ICP=intracranial pressure, TBI=traumatic brain injury, IIH=idiopathic intracranial hypertension, GCS=Glasgow coma scale. Significant differences are in bold.*